JOURNAL OF ELECTRICITY POWER AND GAS

TELEPHONE NUMBER

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879

VOL. XXIII NO. 2 | SAN FRANCISCO, JULY 10, 1909 | PER COPY, 10 CENTS

Electric Appliance Company

HIGH GRADE

ELECTRICAL SUPPLIES

THE QUICK SHIPMENT HOUSE — ELECTRIC APPLIANCE COMPANY

AMERICA'S LARGEST ELECTRICAL SUPPLY HOUSE

726 728 730 MISSION ST. SAN FRANCISCO.

OKONITE WIRE

OKONITE

TRADE MARK REG. U.S. PATENT OFFICE.

THE STANDARD for RUBBER INSULATION

Okonite Tape, Manson Tape,
Candee Weatherproof Wire,
Candee (Patented) Potheads.

The Okonite Company

253 BROADWAY, NEW YORK

WILLARD L. CANDEE, PRESIDENT — GEO. T. MANSON, GEN'L SUPT.
H. DURANT CHEEVER, TREASURER — WM. H. HODGINS, SECRETARY

PARANITE

INDIANA RUBBER AND INSULATED WIRE CO.

Manufacturers of Paranite and Peerless Rubber Covered Wires and Cables
Underground Aerial, Submarine and Inside Use
Telephone, Telegraph and Fire Alarm Cables
All Wires are Tested at Factory JONESBORO, IND.

Electric Appliance Company

728 Mission St., San Francisco — Pacific Coast Agents

Standard Underground Cable Co.

MANUFACTURERS OF

BARE AND INSULATED WIRE AND CABLES

Chicago, New York, Pittsburg, Boston, Philadelphia, St. Louis, Atlanta, San Francisco

PACIFIC COAST DEPT. --- A. B. Saurman, Manager

First National Bank Bldg., San Francisco
Sub-Office—Los Angeles, Cal.

Phillips Insulated Wire Co.

PAWTUCKET, R. I.

INSULATED WIRES "O.K." AND CABLES

"O.K." WEATHERPROOF
"PARAC" RUBBER COVERED

BLACK CORE PARAC RUBBER WIRES

COMPLETE STOCKS CARRIED BY
OUR PACIFIC COAST AGENTS

California Electric Co. LOS ANGELES — Electric Appliance Co. SAN FRANCISCO — Western Electric Co. SEATTLE

Specify....

BROOKFIELD
GLASS INSULATORS

The Standard

PACIFIC METER CO.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

301 SANTA MARINA BUILDING
California and Drumm Sts. San Francisco

John A. Roebling's Sons Co.

MAIN OFFICE AND WORKS, TRENTON, NEW JERSEY

ROEBLING

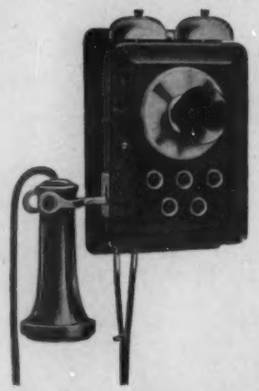
Weatherproof and Bare Copper Wire

LOOK FOR THE ROEBLING SEAL ON EVERY BUNDLE

SAN FRANCISCO, 624 Folsom Street — PORTLAND, 91 First Street
LOS ANGELES, Market and Alameda Sts. — SEATTLE, 900 First Ave. South

FOR INDEX TO ADVERTISEMENTS SEE PAGE EIGHT

"STANDARD"
Battery Telephones



Two-Party, Multiple and Selective Ringing
5-Year Guarantee—Low Cost

CATALOG 8A

Standard Electrical Works
669-71 Mission St. San Francisco

Business Blows Your Way

When you use
General Electric Fans
Summer Custom depends on Cool Fresh Air in your store
Write or 'phone us to-day

STERLING

STERLING
THE MODERN ELECTRIC SUPPLY HOUSE
137 New Montgomery Street
San Francisco Calif.

Efficient Illumination
BRYAN - MARSH
Tungstens
Your Next Order Please
California Incandescent Lamp Co.
671 Mission St., San Francisco Kearny 1077

Henshaw, Bulkley & Co.
POWER PLANTS
19 Fremont St., San Francisco
Fifth and Cypress Streets, Oakland
262 South Los Angeles St., Los Angeles

KLEIN'S TOOLS
For Spring Construction Work Are Time Savers
Linemen are familiar with Klein tools, they are convenient, handy, acceptable to the men on whom the work depends
Do not fail to have our new Catalogue on file.
Our Motto:—"The Best is the Cheapest in the End" 105
MATHIAS KLEIN & SONS, 95 W. Van Buren St., Chicago, Ill.

SIMPLEX
SPECIAL CONDITIONS Met by SPECIAL DESIGN
Prompt Attention
INSULATED WIRES and CABLES
RUBBER — CAMBRIC
THE SIMPLEX ELECTRICAL CO-BOSTON

ALL TYPES RUBBER INSULATED
WIRES and CABLES
Telephone-Electric Equipment Company
Pacific Coast Sales Agents
612 HOWARD STREET SAN FRANCISCO
SEATTLE LOS ANGELES

SIMPLEX
For Suburban Underground Connections
Use Steel Taped Lead Covered Cables No Conduit—Quickly Installed Few Joints
INSULATED WIRES and CABLES
RUBBER — CAMBRIC
THE SIMPLEX ELECTRICAL CO-BOSTON

ductance coil. When the two circuits are properly tuned and adjusted to the same frequency, the discharge of the condenser through the few turns of wire in the inductance will induce oscillations in the antenna circuit, which in turn causes the disturbance in the magnetic field of the earth.

There are several means by which it may be determined when the two circuits are in harmony with one another. One method is to insert a hot wire ammeter between the antenna and the inductance which will indicate the strength of the oscillatory current set up in the same. By manipulating the flexible connections, a maximum reading will be obtained which will indicate that the two circuits are in synchronism. Since the wave length is dependent on the frequency of oscillation, which in turn is dependent upon the capacity and inductance of the oscillatory circuits, it should be clear that the larger the antenna, the longer will be the wave length.

While some wireless systems use separate antenna for receiving messages, the same antenna is used for both sending and receiving in most cases. A switch, however, is provided which disconnects the antenna from the receiving apparatus when sending and from the sending apparatus when receiving.

The principal apparatus in the receiving end is the detector. The function of the detector is to respond to, and make manifest in some way, the electric oscillations set up in the receiving circuits. There are many devices that will serve this purpose. They are used in connection with a telephone receiver, which is very sensitive to weak currents which are made manifest by a loud noise in the receiver. This buzzing sound corresponds to the sound of the spark at the sending station.

One of the earliest types of detectors is known as the microphone. This, in its simplest form, comprises two blocks of carbon with sharp edges, across which rests a steel needle. The steel needle resting across the carbon blocks forms an imperfect contact. When the high frequency oscillations pass through the carbons and the needle, the contact is greatly improved, with the result that the local battery current will be strengthened in nearly direct ratio to the improved contact. This change of current causes a sound in the telephone receiver.

Another type of detector used in connection with the telephone receiver is the electrolytic detector. This consists of a small cup containing nitric acid into which the end of a very fine platinum wire is slightly immersed. In this detector, a film of gas forms between the end of the platinum wire and the acid, which acid is a conductor of electricity. This film of gas insulates the platinum wire from the acid. Hence, there is practically no current flowing through the telephone receiver. When the high frequency oscillations pass through this electrolytic detector the resistance of the gas film is reduced, which allows an increased battery current to flow through the telephone receiver. The platinum wire employed in this detector is so fine and the method of its manufacture so unique, that I shall describe it.

A heavy platinum wire approximately one one-hundredth of an inch in diameter is coated with a suitable thickness of silver. The combined silver and platinum wire is then drawn down to the desired diameter. The close-fitting silver jacket prevents the rupturing of the platinum wire within, during the drawing process. The silver is then removed by immersing it in nitric acid, which leaves the platinum exposed. Platinum wires have thus been drawn to .00006 of an inch.

Another form of detector commonly used is two small pieces of carborundum bearing upon one another by means of a small adjustable spring. In this type of detector the resistance of the contact between carbon points is lowered by the passage of the high frequency oscillations, which in turn permits the local battery current to pass through and produce the sound in the telephone receiver.

A very effective type of detector employs a piece of silicon bearing against a brass point. When high frequency ocsillations pass through this detector, the particles at the point of contact are treated, which causes a sound in the telephone receiver.

An adjustable condenser is provided in the receiving circuit with a capacity of about .002 m. f. to adjust the receiving circuit in synchronism with the antenna circuit. This is made up in a number of ways, a good way is to take an ordinary lamp chimney and coat it with tin foil. The moving part is made up by using a wooden block covered with tin foil.

Variable inductance, commonly known as a turning coil, consists of a wooden spool about 12 inches long and 2½ inches in diameter over which is wound a No. 24 wire. Adjustable sliding contacts are provided on both sides for varying the inductance on the coil.

Operation of the Telegraph Instruments.

In sending a message, the operator first throws in his aerial switch, which connects the antenna with the instruments in the listening position to ascertain whether any other station is talking. If he hears no signals, he assumes that no one is talking and then throws the antenna switch on the sending side which automatically disconnects the receiving instruments. Then the spark gap and variable inductance is adjusted to a certain wave length and now the operator proceeds to press the key and starts sending the message. By pressing the key the current rushes through the primary of the high potential transformer and induces a high voltage, low frequency current: since this current, however, is low in frequency, the condenser and spark gap is used to raise it which results in a high power, high frequency oscillating current. This current is sent up the antenna wire and from there radiates in all directions. The current causes the earth's magnetic field to be disturbed and results in waves which travel through the ether in all directions, radiating from the point of distribution. As these waves traverse the atmosphere and strike another antenna on the distant receiving station, these high oscillating current pass down the antenna through the variable inductance, through the detector and then to the ground. A pair of delicate receivers are connected in shunt across the receiver. While the high oscillating currents pass through the detector, the resistance is lowered which allows the battery current to flow

through the receiver and produces the signal. After the passage of the current, the resistance is again restored to its original value and the current is again ready for another passage of high frequency currents.

Tuning not only increases the radius of operation, but maintains secrecy as well. By means of careful tuning, two distant stations may be sending simultaneously, and if they employ different wave lengths the operator at the receiving end may, by adjusting his apparatus to the wave length of the station with which he desires to communicate, "tune out" the other message, receiving only the one desired. However, if stations be quite near one another, the operator may not be able to tune out the undesired party owing to their proximity and the apparatus is then said to be operated by forced oscillations. Nevertheless, an operator may receive the desired message, by concentrating his mind upon the sound of the spark, but this may only be done when the sounds of the sparks are dissimilar or one louder than the other, owing to the different strengths or to varying distances.

Possibilities of Wireless Telegraphy.

The rapid strides made by wireless the last few years have been such that the average person cannot realize the degree of efficiency it has reached, and still it is advancing. The next few years will see more marvellous advancements than has ever before been known in this mysterious method of communication.

It is over the waters of the Pacific that the world's records in wireless have been made. Every day the boats and land stations of the Pacific are transmitting aerograms for greater distances than those of the Atlantic are even attempting. The steamship "Northwestern," equipped with a kilowatt set of United Wireless instruments, recently, while in the harbor of Alaska, cummunicated with Tatoosh, Washington. The harbor is almost landlocked, high mountains rising abruptly from the shore on all sides.

The feat marks the long distance overland record for wireless, a distance of 750 miles. On the following night that this feat was accomplished, the "Northwestern" operator was in communication with Honolulu, while the ship was crossing Fitzhugh Sound, B. C. This distance is over 2500 miles.

Oversea wireless records are much better than those overland. The receiving of a message from Japan at San Francisco still stands as the greatest feat of its kind in the world. The long distance records for wireless are made at night. As soon as the sun sinks below the horizon, the ultra violet ray of the spectrum is absent, the impulses made by wireless instruments on the ether waves are greatly increased. But for all practical purposes the distance traversed by wireless in the daytime is amply sufficient.

Humming in electric meters is usually due to the magnetic vibration of the tinned sheet iron cover. This slight vibration decreases friction and insures low starting current.

A pole wrapping machine has been designed which will wrap a pole with wire in twenty minutes, thus protecting it from gnawing by horses.

ELECTROLYTIC CORROSION OF TELEPHONE CABLES.[1]

BY ELAM MILLER.

The electrolytic corrosion of telephone cables, due to direct current electrolysis, has been experienced ever since the general introduction of the electric traction system with a track or ground return. Telephone systems in the larger cities have underground plants covering extensive areas which are generally coincident with the principal areas covered by the traction system. The leakage of some current from the track to neighboring underground metallic structures, particularly water pipes and lead cables, even under the best conditions of track bonding, is a condition that has been shown must be accepted as unavoidable, and if preventative steps are not resorted to, corrosion of such structures results.

An examination of a table of the electro-chemical equivalents of elements will show that lead is more susceptible to electrolysis than iron, in fact, assuming a valency of 2 for both metals, which holds in the more common compound of these elements, lead is approximately 3.7 times more susceptible to electrolytic action than iron. Accepting as unalterable the fact that more or less current is certain to stray from the track returns to the lead sheathed cables of the telephone companies, studies of a more or less elaborate nature have been made to determine the conditions most favorable to electrolytic action on such cables and methods of relief have been fairly definitely outlined. It was at first thought that trouble need not be anticipated where the cables were negative to the track or to paralleling metallic structures, such as water pipes, from which current might flow to the cables, and as a general proposition this is true. It has, however, been shown that where a large amount of current flows to the sheaths, there is danger of injury to the cable through the action of alkaline substances formed about the cable through the decomposition, by the current, of the soluble salts contained in the surrounding earth, these alkaline substances being capable, under favorable conditions, of attacking the cable chemically when the currents are shut off or very much reduced, as would be the case at night. In general, however, the points to be feared are those where the current tends to leave the cable for other conductors in the immediate vicinity. The amount of lead dissolved per ampere hour by direct current electrolysis is 3.858 grams, and as the maximum thickness of sheath for full sized (2 11/16 inches) telephone cables is but one-eighth of an inch, and further, as the contact area of the sheath from which current is flowing may be restricted, the resistance low, and the current density consequently high, a relatively small amount of current flowing from the sheath for a sufficient time will inevitably result in a perforation. Further, the action has been shown to be not entirely electrolytic, but where, in the soil, nitrates predominate, the corrosion is greater than the theoretical electrolytic corrosion calculated from the electro-chemical equivalent of lead, due to the chemical attack of the nitric acid which is liberated by the passage of current. Ordinary city soil contains a large

[1]Paper read before San Francisco Section A. I. E. E., June 25, 1909.

percentage of nitrates. As all modern telephone cables are of the dry core types the result is an admission of moisture to the paper core with the consequent loss of, in most cases, a section of rather expensive cable, and what is probably of greater importance, a serious interruption to the service.

As the corrosion of the cable sheath is in general due to the passage of the foreign return current from the sheath to the earth where the cable is in contact either with the damp porous concrete of a manhole or with the damp sides of a saturated duct, the cable may obviously be protected either by preventing the passage of current into the sheath or by preventing the current from flowing from the sheath. The former method would require the insulation of all cables throughout their entire length, including the manholes, and is absolutely impracticable. The latter consists in providing conductors between the grounded power terminals and the cables sufficiently low in resistance to reduce the potential of the cable sheaths to a point where they are no longer positive to their surroundings, and consequently current cannot flow from them to the earth. Another expedient has been resorted to of making insulated joints in the cable sheath for the purpose of breaking the continuity of a long cable and preventing the picking up of current at one point and its distribution at another. This, however, is an expedient of questionable utility and is not in general to be recommended.

In making an electrolytic survey it is of the utmost importance that the condition of an underground cable system, with respect to the potential of the cable sheaths to water mains in the immediate vicinity of the cable, the sides of the manholes and the earth adjacent to or within the manhole, be determined at various times during the day, notations also being made of the volume of traffic on the street railway system at the time of the potential observation. An electrolytic survey consists of a series of such observations made at all manholes where conditions are thought to be critical and the results of these observations plotted on maps of the underground cable system, on which are also shown the traction company's lines and locations of power houses. All of the underground cable sheaths of a telephone system are usually bonded together in the office manholes and bonds between all cables are placed at frequent intervals along the main runs. Where an electrolytic survey indicates a positive condition of the cable with respect to adjacent underground structures or the earth, bonds are occasionally run to such structures. In general, however, a study of the potential chart will show that areas where the potential of the cable sheath is positive to the earth are nearest the grounded terminal of the foreign source of current. This indicates that the sheaths of the cables are acting as return conductors for the grounded power system and to complete the return to the grounded terminal of the power generators, the current leaves the sheaths and passes through the earth. It is, of course, evident that this is the condition which it is desirable to prevent. The method usually adopted to accomplish this is to provide a path of low resistance from the cables to the grounded power terminal by a heavy conductor; never by bonding to the rails of a street railway system, as such an arrangement would give rise to difficulty in the event of broken track bonds or changes in load, of which no warning would be given.

The size of the conductor to be connected to the grounded power terminal and its point of attachment to the telephone cables should be such as to render negative the district shown on the potential map as positive. The actual size of this conductor is usually determined by experiment, as there are so many variable conditions that any attempt to calculate it would be a waste of time. The conductor must be large enough to bring about the desired results of rendering the sheaths of the cables in the danger area negative, but at the same time should not be unnecessarily large so that more current is conducted through the cable sheaths than need be, as this tends to increase the chemical corrosion to which attention has been called. Where the circuits of the electric traction system are arranged with return feeders, it may be necessary to treat the return feeder grounds as so many distributed power houses. Complications may also occur where there are a number of power houses that may be run at different times. Under such condition, the connections from the telephone cables to the power houses should be so arranged as to ensure the proper relations of all cables to their surroundings under any combination of sources of current supply that the electric railway company or companies may employ. This can only be accomplished by frequent and careful potential observations in a district that has been determined as dangerous from careful surveys.

I believe it may be safely said that it is the feeling today, at least among telephone companies, that they are able to cope successfully with direct current electrolysis. It is, of course, true that some damage is done each year to the underground plant from this cause, but with a fairly frequent system of potential observations, this can be reduced to a minimum. The worst condition with which we have had to contend is a change in the method of feed adopted by the traction system and the installation of new substations. If advice could be immediately obtained of both of these conditions, precautionary measures could be taken that would render our system practically immune from electrolytic corrosion by direct current. I have in mind a rather serious case of electrolytic corrosion that took place in one of our larger exchanges some two years ago as a result of a rather general change in feed of the traction system. In this instance all of the damage occurred between the visits of the inspector, which were not over three months apart.

In order to guard against changes of this sort, we have considered the advisability of bringing certain cable pairs through the lead sheath at critical points, attaching one wire to the sheath and the other to a ground connection in the manhole. The office ends of these pairs are then connected to a row of jacks at the wire chief's desk, in conjunction with which may also be associated small reverse current relays to operate either a visual or audible signal. Such an installation, omitting the reverse current relays and signals, has been made in one of the medium sized telephone exchanges in California, and it is thought that the insurance against electrolytic action that it certainly affords is well worth the cost of installation and fixed charges

on the cable pairs. An electrolytic survey in this particular exchange is made as a matter of routine each day by simply plugging into the jacks with a voltmeter.

With the advent of the single phase road it was thought, in that the methods applicable to the prevention of corrosion by direct current electrolysis would evidently not apply with alternating current since the potential was periodically reversing, serious trouble might be anticipated—the thought being that the effect of the flow of current from the cable would not be entirely overcome by the flow in the reverse direction, particularly at low frequencies. An apparently very thorough investigation of the question of alternating current electrolysis undertaken by Mr. J. L. R. Hayden, and published in The Proceedings for March, 1907, indicates that the action of the positive half wave is not quite overcome by the action of the negative half, but the difference is so small as to hardly exceed one-half of one per cent of the electrolytic action of an equal direct current. Mr. Hayden also outlines what appears to be a most effective preventative method. This consists of the superimposing upon the stray alternating current of an extremely small direct current, in the tests made by Mr. Hayden a direct current as small as 1.5% of the total value of the stray alternating current afforded complete protection. To quote from Mr. Hayden's paper his explanation of the protective action of the small direct current is as follows:

> Since electrolytic action of the alternating current appears as a small difference between two large and nearly equal quantities, the action of the positive and of the negative half wave, a very small variation in the action of either half wave makes a very large difference in the result, and this probably accounts for the very large variation in the electrolytic action of alternating current compared with the constancy of the electrolytic action of direct current.
>
> Regarding the protective action of a small direct current, against alternating-current electrolysis, it must be understood that this is not due to maintaining the lead negative against the ground. It is obvious that the lead would be protected against corrosion, if upon the alternating current a direct current were superimposed sufficiently large to maintain the lead always negative. This, however, would require a direct current more than 2 times the alternating current, which is not practical. From the previous tests, it appears that a direct current of 1.5% of the alternating current gives practically complete protection against the electrolytic action of the alternating current. Such a small direct current would not appreciably change the duration of the successive half waves of alternating current, but the lead would still be positive for practically half the time; and with such a current graphically superimposed upon the alternating current, the eye would hardly see the difference in size of the two half waves of the resultant current.
>
> It seems that a very small increase of the negative half wave over the positive half wave of the current is sufficient to make the negative half wave completely reverse and thus neutralize the action of the preceding positive half wave.

I should conclude from this that serious trouble need not be anticipated from the alternating current electrolytic corrosion if proper precautions based on these facts be followed.

An alternating current battery is the latest in galvanic cells. The electrodes are sheet iron and the electrolyto consists of equal volumes of a two per cent solution of sulphuric acid and a saturated solution of bichromate of potash. The voltage alternate between plus 0.4 volts and minus 0.4 volts.

THE MODERN TELEPHONE CABLE.[1]

BY FRANK B. JEWETT.

To those not closely in touch with the telephone situation today, the importance of the modern telephone cable may be indicated by stating that of the 8,000,000 miles of wire in the exchange plants of the Associated Bell telephone companies, more than 6,800,000 miles are in the form of underground, aerial, or submarine cable. These figures refer solely to the wire used for outside construction and do not include the thousands of miles of wire in cable form employed in central offices or the wiring of large buildings.

At the present time the bulk of the cable in any telephone plant is used in connection with exchange construction in urban districts. For a large part of such work the concentration of hundreds of circuits in the form of cables is the only available method of providing the facilities necessary to meet present-day service demands, which in many of the larger cities exceed one telephone for each 20 inhabitants, and in a few cities more than one for each 10 inhabitants.

It should be clearly recognized, however, that even the best cable circuit is much less efficient than an open-wire circuit; for example, one mile of the No. 19 B. & S. guage cable circuit ordinarily employed in exchange construction results in as much current attenuation as 35 miles of No. 8 B. W. G. open-wire copper toll circuit, or 3.5 miles of the smallest size open-wire iron circuit used in rural exchange work. From these figures it is apparent that the extensive use of cable necessarily results in a material reduction of the radius within which satisfactory commercial transmission can be given, and as the most advanced telephone art today is only with difficulty meeting the increasing demands for long-distance service, cables can be substituted for open wires only when the further maintenance of open-wire circuits becomes impracticable. It is on account of this decrease in efficiency that the telephone company expends such large sums to retain open-wire circuits for its toll lines as close as possible to the central office, but even in this portion of the plant increasing numbers of circuits have forced the abandonment of pole lines in certain situations.

In another direction also the necessity for cable construction has developed to a certain extent; namely, providing the necessary circuit facilities between very large cities separated by moderate distances and between which there is a great deal of terminating telephone business; thus at the present time the business between New York and Philadelphia, New York and New Haven, and Chicago and Milwaukee, is handled over all-cable circuits.

The extensive application of cable construction in the modern telephone plant just outlined has been made possible only through the development of a form of cable exceedingly efficient as compared with the earlier forms. It is the purpose of this paper to consider a few of the essential requirements which have had to be met in the production of such a cable. While certain features of the manufacturing processes are described in order to explain the method of obtaining

---

[1]Summary of paper presented at the 26th annual convention of the American Institute of Electrical Engineers, Frontenac, N. Y., July 1, 1909.

certain characteristics, the paper is in no sense an exposition of the technique of cable manufacture. In order to show how the telephone engineer ensures the production of a cable having the desired characteristics, clauses covering the points discussed have been taken from the standard form of cable specifications employed by the Associated Bell companies.

The Essential Requirements of the Modern Telephone Cable.

The essential requirements for an efficient and satisfactory telephone cable, while primarily electrical, are of course unavoidably connected with mechanical and cost restrictions. These requirements, which must be fulfilled by the cable and which form the basis of present-day cable specifications, are briefly as follows:

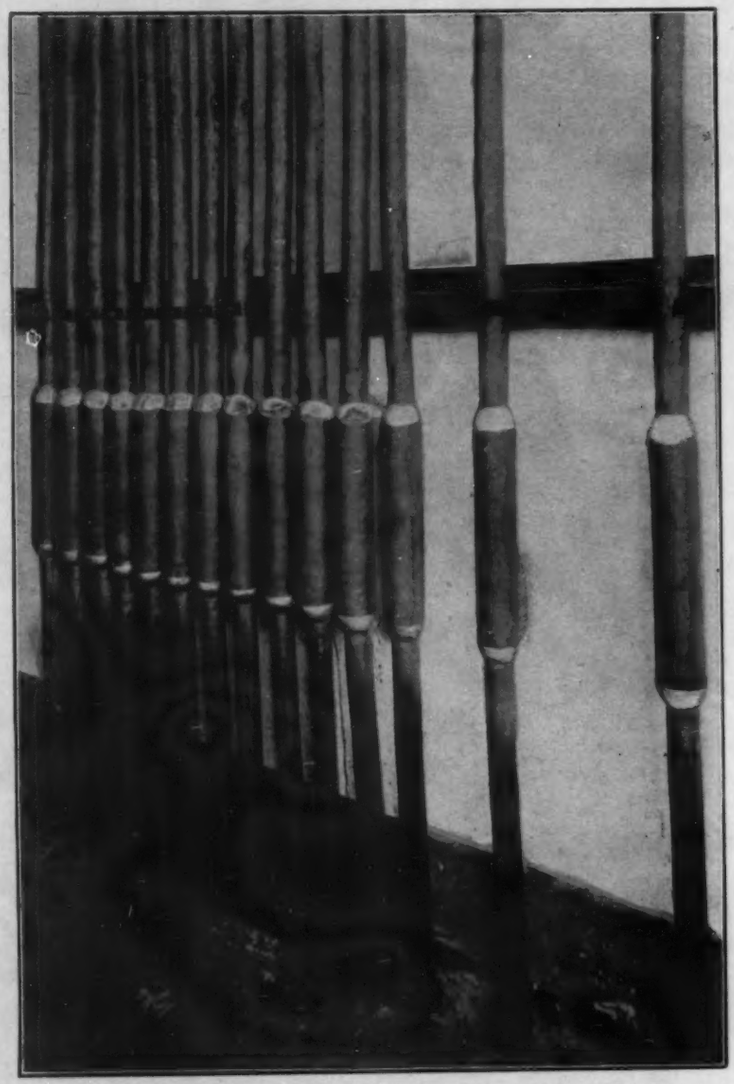
1. That the cable shall provide the maximum number of independent and non-interfering circuits within the minimum space.

2. That these circuits shall have the maximum transmission efficiency for currents of telephonic frequency, compatible with the other electrical and mechanical requirements.

3. That the dielectric strength of the cable shall be such as to ensure against failure from any of the potentials normally employed and to make possible its protection against damage from lightning and from foreign circuits operating at potentials in excess of those employed on telephone lines.

4. That the mechanical arrangement adopted to obtain the necessary electrical properties shall be such as to insure a continued maintenance of these properties after the cable has been installed. This assumes a construction which will withstand the hard usage unavoidably connected with cable installation.

5. That this mechanical construction shall be made at a cost which will render the cable circuits economically available in comparison with other known means of circuit provision.



Splices. 10,000 Wires Joined to 10,000 Others. Upper Ends Insulated With Wool. Lower Ends With Paper. Part of Equipment of Howard-Street Central Office, Home Telephone Company of San Francisco.

In addition to the foregoing, certain subsidiary requirements dealing with the general size of the cable desired; that is, the size of wire and number of pairs required; the method of circuit identification (color scheme); the length of cable sections to be furnished; the method of preparation for shipment and some form of guarantee which will insure high-grade material and workmanship in the manufacture of the cable, are ordinarily covered in the cable specification.

Standard Cable Construction. While differing somewhat in details, the essential features of all modern telephone cables, known as dry-core paper-insulated, are the same whether the wires are in the little five-pair or ten-pair subscribers' cables ordinarily strung on pole lines or in the largest sizes employed underground. Cables of this type are in one respect fundamentally different from cables which employ rubber or gutta-percha insulation. In the latter construction the dielectric which surrounds the wire serves not only to keep the wires in proper position, but being itself impervious to moisture, the dielectric serves to maintain the efficiency of the circuit, whether exposed to moisture or not. The telephone cable, on the other hand, belongs to that class of cables in which any solid dielectric employed is used primarily as a mechanical separator or to give the requisite dielectric strength. In this class of cables the deleterious effects of moisture are guarded against by surrounding the conductors with a water-tight metallic sheath.

For making up telephone cables, wires of the proper size are first insulated by wrapping them individually with dry paper ribbon. This ribbon, which is usually about $\frac{5}{8}$ in. wide and of a thickness varying from 0.002 in. upward depending on the size of the wire, and colored in some distinctive fashion, is spirally applied, but not with such a tension as to cause it to adhere closely to the wire. For the ordinary underground or aerial cable a single wrapping of paper suf-

fices; in some forms of submarine cable two wrappings of paper, laid on in reversed directions, are used. In any event, the ribbon is overlapped sufficiently so that the wire is completely covered. Thus insulated, the wires are twisted together in pairs, the two wires of a pair being insulated with different colored papers and the length of twist depending upon the size of the conductors and the use to which the cable is to be put. The maximum length of twist, however, rarely exceeds 6 in. and for the smaller sized wires is ordinarily under 4 in. This twisting of the individual circuits is for the purpose of neutralizing inductive and capacity effects, which would occasion "crosstalk" between the various circuits if the wires of the core were laid up parallel to one another.

The core of the cables is made up in cylindrical form by assembling the requisite number of twisted pairs together in concentric layers one or more pairs thick, the pairs in each layer being arranged spirally about the axis of the core and the direction of rotation in the alternate layers being reversed. As explained below this use of a concentric layer construction is adopted to ensure the necessary mechanical stability for the completed cable. The number of pairs in each layer is dependent upon the size and capacity of the cable required and is varied by changing the size of the central strand.

When the cylindrical core has been completed, it is wrapped with one or more thicknesses of paper tape to bind the conductors firmly in place, present a smooth exterior surface, and prevent the lead of the sheath from coming in contact with the insulation of the outer layer of conductors. This wrapping also gives the higher dielectric strength needed in the pairs of the outer layer. During the process up to this point the paper, being hygroscopic, has unavoidably taken on more or less moisture which must be removed before the sheath is applied. To this end the core, suitably reeled, is placed in a drying oven in which air at a high temperature is circulated for a considerable period, after which the core is taken immediately to the lead press and the final sheath applied. This completes the process except for the testing, sealing of the ends and reeling for shipment.

While the individual wires forming the core of the cable just described are wrapped with paper, the cable is essentially different from the ordinary paper-insulated power cable, in that it is in effect an air-core construction. The paper, which is loosely applied and fills only a part of the total space not occupied by the conductors, is deformed in the process of cabling and serves merely as a mechanical separator to keep the wires apart and not as a dielectric per se, or as the carrier for a dielectric compound. In cable of this type, the real dielectric is the dry air between the wires.

To show how nearly the present dry-core cable meets the essential requirements of the telephone industry, it may be interesting to examine some of these requirements and their actual fulfillment in detail and also the evolutionary process by which the present form of construction has been arrived at.

Choice of the dielectric.

Specification requirement: Each conductor shall be insulated with a single wrap of paper spirally applied.

In designing a cable for high-frequency current transmission work the principal requirement, as previously noted is that it shall combine the maximum number of independent non-interfering circuits having a maximum of transmission efficiency within the minimum space and at a minimum cost. It is essential, therefore, that the dielectric selected for maintaining the proper separation of the wires and providing the necessary mechanical properties required of the cable should have both a low dielectric capacity and small dielectric hysteresis. These features, which in power cables designed for transmitting large amounts of low-frequency, high-potential current may be of secondary importance compared with high insulation and high dielectric strength, become paramount when the question is one of securing an efficient cable for the transmission of small currents having frequencies ranging up into the thousands of periods per second, and in which high dielectric strength is a matter of secondary consideration.

For rubber-insulated and cotton-impregnated-insulated cables both the capacity and conductance are materially higher than in the dry-core, paper-insulated cable, and by calculation it is found that the attenuation constant of the impregnated cable is 24 per cent, and that of the rubber 40 per cent, higher than that of the dry-core paper cable; also that while the dissipation of the dielectric increases the attenuation in the latter cable by less than 0.2 per cent at 1000 periods per second, that in the impregnated cable increases it by 1.05 per cent and in rubber insulated cable by 2.10 per cent. In addition to the effect of dielectric dissipation increasing the attenuation of the cable, the fact that this increase is not constant for all frequencies but it is greater the higher the frequency, results in a cable with high dielectric dissipation having more distortion than one in which the dissipation is low over the range of frequencies involved in speech transmission. From the small value of the dissipation constant dry-core cable gives conditions closely approximating to those in which nothing but air would intervene between the wires. In addition to the numerous mechanical, electrical, and economic defects which obtained in impregnated and rubber-cored cables, the fact that they were materially inferior in efficiency to the present type of dry-core construction was one of the principal factors leading to the adoption of the latter.

While the standard telephone cable of to-day is essentially an air-core cable, the amount of solid dielectric necessary for mechanical reasons is appreciable, and in specifying a wrapping of high-grade dry-rope paper ribbon the aim has been to utilize a material which will have the lowest possible dielectric capacity and dissipation, and at the same time possess the necessary mechanical properties to permit of its use in comparatively small quantities. That the paper should be spirally applied to the wires rather than put on in some other fashion is the result of actual experience with other types of construction. In the early days of dry-rope paper insulation, numerous schemes for applying the paper were suggested and tried, with the result that spiral application was found to afford the greatest immunity from accidental crosses during installation while at the same time requiring a minimum amount of solid material in the core.

Insulation resistance.

Specification requirement: In every length of cable each conductor shall show an insulation resistance of not less than 500 megohms per mile of cable at 68 degrees fahr., each conductor being measured against all the rest and the sheath.

For telephone cables made in the United States the foregoing requirement is the one ordinarily specified. In Europe the insulation requirements are frequently very much more severe than this, and sometimes necessitate drying the cable after it is laid and spliced.

It is extremely doubtful, however, whether a high insulation specification can be justified in view of the extra expense incident to meeting it and the exceedingly small improvement in transmission resulting therefrom. The result of American practice has indicated that the specifications of an insulation resistance which will ensure honest manufacturing processes, a reasonable amount of drying and a permanent product, is all that is warranted. As a matter of fact the regular drying processes adopted ordinarily give an insulation resistance materially above 500 megohms, although under the exceptionally humid conditions frequently prevailing in the summer months, the insulation at times approaches the specification figure.

High insulation is not in itself necessarily an indication that the cable will be efficient. Thus rubber-insulated cables which have an insulation resistance of thousands of megohms per mile are decidedly less efficient than dry-core cables of the same capacity whose insulation is 500 meghomes per mile. Since the principal dielectric loss in a dry-core cable results from dielectric hysteresis, rather than from direct conduction, the specification of an insulation resistance requirement must, as previously stated, be looked upon primarily as one to insure an efficient process of manufacture and provide for a cable core which will not be subject to deterioration. Experiments show that while the transmission efficiency may be increased 7.1 per cent by the process of drying, the improvement due directly to the increased insulation resistance is less than 0.001 per cent, that due to the reduced capacity being 7.0 per cent and that to the reduced damping constant 0.1 per cent. As to whether further drying would not result in still further improvement, it can be said that beyond the period of drying ordinarily employed, the dielectric capacity and damping constant of paper show but little further reduction even with the most elaborate drying by chemical processes. Such processes, on account of their expense, could probably never be justified in any but exceptional cases.

Dielectric strength.

Specification requirement: The insulation of each conductor shall be capable of withstanding a potential of 500 volts without rupture.

All dry-core paper-insulated cables used by the Associated Bell Telephone Companies are required to withstand a direct-current potential of 500 volts between any wire and its mate, or between any wire and all of the remaining wires and the sheath of the cable. As noted previously, this requirement is incorporated not only to guard against the danger from failure due to the normal potentials met with in telephone operation, but chiefly that the cable circuits may be efficiently protected from lightning or when they come in contact with light or power circuits. Past experience has shown that efficient protection without unduly great maintenance charges can be obtained only by providing open space cut-outs which will operate at potentials lower than the break-down potential of the cable. As it is not feasible to maintain open space cut-outs with operating potentials much below 500 volts, this figure marks the minimum dielectric strength which admits of suitable protectors. For certain classes of cables, where the exposure conditions either to power circuits or to lightning are exceptionally severe, or where, as at submarine cables crossing in the center of long toll lines, the inability to quickly clear trouble or repair damage would involve serious interruptions of service, special high dielectric requirements are frequently specified.

Electrostatic capacity.

Specification requirements: In every length of cable the average mutual electrostatic capacity of all the pairs and the mutual electrostatic capacity of any pair, per mile of cable at a temperature of 68 degrees fahr. shall not exceed the values given in the following table, the capacity shall be measured between one wire of a pair and its mate, the remainder of the conductors being connected to the sheath.

For cables used in exchange construction, such, for instance as No. 19 gauge of 300 pairs or less, the mutual capacity referred to in the above quotation ordinarily averages slightly below 0.080 mf. Thus for a 300 pair No. 19 B. & S. gauge cable the specification average is 0.077 mf. and the maximum 0.084 mf. per mile for each length, while for cables of 249 pairs or less the corresponding figures are 0.070 mf. and 0.079 mf. respectively.

In the foregoing specification requirement the capacity is that measured by the ordinary charge or discharge method. While this constant is not that directly applicable to the computation of transmission efficiency for high frequencies, it is justified in manufacturing specifications on account of the difficulty of making accurate high-frequency determinations. It is also justified by the fact that in a thoroughly dried cable the capacity determined by the discharge method is not greatly in excess of the high-frequency capacity.

With dry-core paper construction by a proper cabling of the pairs, the capacity of the cables can be varied at will within a moderate range to meet different transmission conditions, while at the same time retaining the necessary mechanical and electrical properties. Owing to irregularities in manufacture and differences in location within the core, all the pairs do not have exactly the same capacity. For this reason, it is customary to specify both an average mutual capacity limit for all the pairs in each length and also the maximum mutual capacity limit of any single pair. This insures the proper efficiency for the completed cable run without putting such a stringent limitation on the uniformity of the product as to render the cost excessive.

It is now customary to specify mutual rather than grounded capacity, as the former is a constant of the cable directly indicative of its transmission efficiency. So far, however, as ensuring efficient construction and good workmanship are concerned, either mutual or

grounded capacity would suffice, since within the range of capacities ordinarily met with in telephone cables the relation between the mutual capacity of a pair and the grounded capacity of its component wires is fairly constant, the mutual capacity being approximately 60 per cent of the grounded capacity.

If an attempt is made to secure too low a capacity by separating the wires and employing too small an amount of paper, the core becomes so soft that the completed cable is easily deformed, and consequently extremely hard to handle; on the other hand, any attempt to secure an extremely high capacity by putting an excessive number of pairs in the core renders the cable stiff and unwieldy, or if the amount of paper is sacrificed the dielectric strength will be unduly low. Experience has shown that an average mutual capacity of about 0.050 mf. per mile marks the lower limit for single-wrap paper cable which can be readily handled without undue deformation, while approximately 0.09 mf. per mile marks the upper limit. Between these two limits practically any desired capacity can be obtained, although on account of having to conform to a limited number of cabling schemes it is not always possible to secure a uniform gradation of capacity with a specified sheath diameter and number of pairs.

Sheath.

Specification requirement: The core shall be enclosed in a sheath composed of an alloy of lead and tin, the amount of tin by weight to be not less than 3 per cent. The sheath shall be free from holes or other defects and shall be of uniform composition and thickness.

For the mechanical protection of the core wires during and after installation and for preventing the ingress of moisture at all times, a continuous sheath composed of an alloy of lead and tin is molded firmly about the finished and dried core. This sheath, which varies in thickness from 1/12 in. to 1/8 in. for aerial and underground cables, depending upon the size of the core, is molded in a continuous section over each individual length of core immediately on the removal of the latter from the drying oven.

To ensure uniformity of practice in the cable plant it is necessary to set some limit on the maximum diameter of the sheath. At the present time the standard for a full size cable is 2⅝ in. outside diameter, this being the limiting size that can be satisfactorily drawn into a standard 3 in. duct. A cable of this size will contain 300 pairs of No. 19 B. & S. conductors having the capacity noted above.

No single problem connected with the development of the modern telephone cable has probably been so difficult of solution as deciding upon the proper type of sheath, and the brief specification clause quoted above embodies the results of years of experience. Unlike most of the other features of the cable, the proper requirements for the sheath could not be forecast to a large extent and many indeed have resulted from conditions developed since the use of cable was first begun.

At the time when impregnated-cotton-insulated cable was the standard construction, the sheath was formed up separately and the core drawn in. This necessitated a considerable amount of clearance between the sheath and the core and although the entire inner space was ultimately filled with paraffin or resin oil, the cable had a decided tendency to buckle and crack if bent on any except a long radius. For this reason and because it was frequently necessary to relocate cables in the plant, early specifications usually contained a clause stating that the completed cable must be capable of being wound and unwound a certain number of times on a drum of specified diameter without buckling or cracking. This requirement was to ensure the cable being serviceable when withdrawn from the duct.

The process also limited the length of sheath which could be continuous, so that where long lengths of large cable were needed to fit suitable manhole spacings, factory joints in the sheath had to be resorted to. The care in making these so as to withstand the rough treatment incident to pulling into the duct was such as to greatly increase the difficulties and expense of manufacture. As a result of the defects in the earlier forms the present process was developed of moulding the sheath directly on to the dried core so as to closely fit it, eliminating at once the necessity for factory joints and the need for clearance between the core and sheath.

The specification of a 3 per cent tin alloy for the sheath is likewise a result of experience gained in the early days of cable development. Added primarily for the purpose of hardening the sheath so as to better withstand rough usage during manufacture and installation, the amount of tin used was long a matter of individual preference. The present standard requirement was only arrived at when a careful investigation was made to determine the proper remedy for the cracking of aerial cable sheaths, which developed when the sheath was subjected to continued vibration. At the time there was a very strong sentiment in favor of pure lead sheath for such cables, a sentiment based largely on the poor showing made by alloy sheaths in a number of instances and the feeling that a softer sheath would be less likely to crystalize. It was only when exhaustive laboratory experiments had shown the great superiority of a proper alloy over pure lead that the final solution was reached.

With the advent of creosoted wooden conduit a great deal of trouble from the chemical corrosion of the sheaths was experienced. In these earlier ducts, wood creosote was the preservative agent employed, but owing to the presence of considerable acetic acid, this had a ruinous action on sheath materials. Elaborate experiments at the time proved that while not wholly free from such corrosion, the 3 per cent tin alloy sheath was corroded much less than one of pure lead or with but a small proportion of tin. While improvements in the process of creosoting by the substitution of dead oil of coal tar for wood creosote thereby eliminating the acetic acid, and the advent of vitrified clay ducts, have practically eliminated chemical corrosion from the field of cable trouble, it was one of the factors which at the time led to the adoption of the present standard sheath material. Although an excess of tin renders the alloy too hard and brittle, only the minimum limit needs to be specified, the high price of tin automatically keeping the amount used as small as possible.

Cable specifications. In conclusion, a word might be said about the standard cable specifications to which reference has already been made. These specifications

aim primarily to secure a certain standard for the finished product without unduly restricting the manufacturer as to the exact processes he shall employ to attain the desired end. While certain of the mechanical characteristics are incorporated, such as the use of a particular alloy for the sheath, and the employment of paper insulation to the exclusion of other materials, it is on account of experience having shown them to be the best available.

As a result of this aim, the specifications, though brief, have the clauses so drawn as to ensure the equivalent of a process known to be satisfactory. In the matter of brevity the present-day specification is analogous to the earliest specifications, which also aimed at a suitable finished product without specifying particular processes. There is this marked difference, however: much of the brevity of the earlier specifications resulted from an insufficient knowledge of the characteristics and possibilities of the materials and processes employed, while the brevity today is the result of a definite knowledge gained from long experience and a more comprehensive conception of the fundamental laws governing the efficient transmission of high-frequency currents, of just what each material will do under varying conditions and just what the limitations of any particular process are.

Between the specifications of the late '80's and those of today an era intervened in which it was frequently customary to specify minutely the exact process to be employed and the behavior of the finished cable under widely differing conditions, such, for instance, as the specification of just what the allowable capacity should be at a number of different temperatures. And however much future specification requirements may differ from those of today as regards subject matter, owing to advances in the art, the laws governing the propagation of currents along wires are sufficiently well known to make a recurrence of this type of specification unlikely.

The international candle is a unit of light that has been submitted to the International Electrotechnical Commission for approval. The unit is already common to the national standardizing labobratories of America, France and Great Britain, having been adopted April 1, 1909, in the United States. It has the same value as the pentane candle, the bougie decimale and the American candle and is 1.11 times the Hefner unit and 0.104 the Carcel unit. The new American candle is 1.6 per cent less than its former value, thus making a lamp formerly rated at sixteen candles now equal to 16.26 of the new unit. After July 1, 1909, the new unit will be adopted by the Bureau of Standards in the certification of electric standards and it is expected that manufacturers of electric lamps will adopt it soon after.

Examination for Engineer in Wood Preservation is announced by the United States Civil Service Commission on July 21, 22, 1909, to fill a vacancy in the position of engineer in wood preservation, Forest Service, $1,000 per annum, and vacancies requiring similar qualifications as they may occur.

PATENTS

925,561. Suspension of High-Tension Lines. Harold W. Buck, New York, and Edward M. Hewlett, Schenectady, N. Y., assignors to General Electric Company. In a system of suspension for high tension power circuits, the combination of a series of flexibly connected link strain insulators between line wire and cross arm, the number of said insulators being proportioned to the electrical potential, and each insulator being provided with a rain shed to preserve dry some part of its surface in the path of possible electric discharge irrespective of the direction of the beating rain, and means for flexibly connecting said series of insulators to the cross arm and to the line wire.

925,609. Microphone. Marve R. Stuart, Wheeling, W. Va. In a relay, the combination of two or more magnetic circuits comprising separate armatures, a microphone comprising a pair of electrodes movable toward and away from each other, a pivotal arm connected to one of said electrodes and one of said armatures and another pivotal arm connected to the other of said electrodes and to the other armature, and coils for receiving the voice currents and varying the flux entering said armatures in such a way as to cause the microphone electrodes to move simultaneously in opposite directions.

925,594. Fault-Locator for Electric Cables. Walter O. Pennell and Henry L. Hoffman, Kansas City, Mo. The method of locating a fault in a conductor of a cable having a metallic sheath, which consists in causing varying current to flow through the conductor by way of the fault by connecting one pole of the generator of said varying current to one end of said faulty conductor and the other pole to earth, causing the varying current flowing in said conductor to induce unequal currents in two differential windings of an exploring coil by presenting said windings to said conductor at unequal distances therefrom, and causing the varying current that flows through the metallic sheath of the cable to induce equal and opposing currents in the two differential windings of said coil by disposing said windings at equal distances from said sheath.

925,573. Telephone-Exchange System. William A. Fricke, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company, Chicago, Ill. An interior telephone system including a plurality of stations, a battery for supplying the transmittors at each of said stations with current, calling switches at each of said stations whereby each of said stations may be brought into connection with a selected one of the other of said stations, each calling switch, when actuated, serving to permit the connection of the outgoing terminal of the transmitter at each connected station with the incoming transmitter at each connected station with teh incoming transmitter terminal of the other connected station, and an additional switching device at each of said plurality of stations serving normally to connect one terminal of the battery with conductors leading to similar terminals of the transmitters, each of said switches serving, and hold the same from spreading laterally, said tie rods being interposed between and constituting stops for the shelves of the respective pairs, as and for the purpose specified.

925,775. Appliance for Use With Telephone-Transmitters. Edward F. Hutton, New York, and George A. Ellis, Jr., Bay Shore, N. Y., assignors to The Miniature Telephone Booth Co., New York, N. Y. A telephone box or casing having means for detachably securing a portable telephone set therein; a door secured thereto, and a facial opening in the door, said box or casing being provided with two linings, one of which is a non-absorbent of sound and the other a non-absorbent of liquids, substantially as described.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

E. B. STRONG, President
E. M. SCRIBNER, Vice-President and General Manager
A. H. HALLORAN, Secretary and Managing Editor

DIRECTORS

R. J. DAVIS A. M. HUNT E. M. SCRIBNER C. L. CORY E. B. STRONG

604 MISSION STREET, SAN FRANCISCO.

TELEPHONE . . . . . KEARNY 918

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	4.00
Single Copies, Current Month	each	.10
Single Copies, prior to Current Month	"	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Wireless Telegraphy.....*By O. P. Guldemeister* 23
Electrolytic Corrosion of Telephone Cables..*By Elam Miller* 26
Humming in Electric Meters 26
Pole Wrapping Machine 26
Alternating Current Battery 28
The Modern Telephone Cable.....*By Frank B. Jewett* 29
International Candle 33
Examination for Engineer in Wood Preservation..... 33
Patents 33
Editorial 34
- Electrolysis.

Current Comment 35
- Wireless Ship Bill.
- Distinctive Colors for Piping.
- Reforestation of Burned Areas.
- Electrolytic Sewage Treatment.
- Storage of Coal Under Water.
- Insulator for Coast Lines.
- Number of Wireless Stations.
- Telephone Cables Under San Francisco Bay.
- Telephone Facilities on the Isthmus.
- Electric Fog Signal.
- Comparative Telephone Costs.
- Yellow Pine for Telephone Poles.

Personals 36
Change in Management Western Electric Company..... 36
Books Received 36
- Through the Yukon and Alaska.
- Design and Construction of Induction Coils.

News of the N. A. S. E..... 37
California Independent Telephone Association..... 38
Trade Notes 38
New Catalogues 39
Industrial 40
- A Monster Cable.
- Repeating Coils for Phantom Circuits.
- Tungsten Life-Saver.
- Tungsten Shop Cluster.
- Old Dutch Cleanser Electric Sign.
- Dean Salesmen.
- Westinghouse Electric Mine Installations.
- K. & G. Double Boring Machine.
- Progress in Cuba.
- Consolidation of Book Publishers.
- Foster Superheaters.
- San Francisco Magnetic Brakes for Philadelphia.
- Pacific States Electric Company.

News Notes 43

Electrolysis

The life of the telephone cable is a hard one. Driven from the air by its foes, it seeks the protection of the ground, only to be assailed by new enemies. As an aerial it is exposed to mechanical injury, vibration and lightning, as well as municipal regulation. Underground, it is the prey of corrosion, either chemical or electrolytic, and in Southern California and Australia it is attacked by the cable bug. All these belligerent bed-fellows work insidiously and give no warning until the damage is done, the sheath perforated, the cable destroyed and communication interrupted.

The chief offender in this respect is the vagabond current from electric railways, which, like all its ilk of the genus hobo is ever seeking free transportation. It is inherently lazy and following the line of least resistance it finds the lead sheath of the telephone cable a most convenient carrier. In its entrance it does no damage, but in its exit at some moist spot it finds all the essential constituents of an electrolyte in the salt-laden ground water. Its action was first noted in the pitting and grooving of cast iron water pipe, but the extensive use of lead covering for cables and lead service pipes has shown that this metal is even more susceptible to deterioration from electrolytic action. By complex chemical reaction the metallic lead is converted to white lead. This misdirected energy would be invaluable to paint manufacturers, but as a cable protector, white lead is far from being a success.

Recognizing that such current leakage is usually unavoidable, the telephone engineer attempts to minimize the damage to his cables by preventative measures. The fundamental requirement is to keep the cable dry by means of well drained conduits and watertight joints. But notwithstanding the most stringent prohibition, it seems impossible to perpetuate dryness. Even in Arizona's desert the thirsty can find a sustaining drink in the cactus. Nature's abhorrence of dryness seems as universal as a cat's proverbial antipathy to water. So when the current takes a transfer it usually finds water.

These transfer points can be located by a series of observations of potential differences which may be combined to make an electrolytic survey. From a study of this it is possible to so ground and bond the conductors as to prevent much damage to the cables. This solution, however, at the best, is but temporary and the final elimination of the difficulty rests on a proper understanding and co-operation between the engineering forces of the interests involved. Few electric railway men realize how much energy is being wasted in employing the ground as a return circuit, and they usually wait until compelled by law to improve their bonding or provide metallic return. If friendly relations can be established so that the telephone engineer may know of contemplated changes he will be prepared to meet the new conditions that will arise in his own circuits.

CURRENT COMMENT

A wireless ship bill introduced in the Senate provides that all ocean steamships carrying more than 50 passengers must be equipped with wireless apparatus when making trips of more than 200 miles radius.

Distinctive colors for power plant piping to identify the various lines of pipe is being advocated to eliminate confusion among the workmen. It is hoped that such methods will be standardized throughout the country.

Reforestation of burned areas is being experimentally tried on a large scale by the United States Forest Service on the Soleduck river in the Olympic National Forest in Washington. Douglas fir will be used in re-seeding.

Electrolytic treatment of sewage at Santa Monica, California, has proven eminently satisfactory after a year's test. Of the $400 average monthly cost, three-eighths is for electric current and the balance for engineering services and attendance.

Storage of coal under water minimizes danger of spontaneous combustion and prevents deterioration of calorific power. Upon exposure to the air in some climates one-fifth the heating value may be lost in one year by oxidation and evaporation.

An insulator for coast lines exposed to salt spray and dust has been designed by G. Anfossi as the result of experiments on a transmission line near Genoa, Italy, employing 25,000 volts. It consists of a large flat upper bell mounted on a smooth sleeve, all affording no cavities to collect dust.

The number of wireless stations listed in the latest issue of the Bureau of Naval Equipments' compilation is 782 shore and floating stations. The United Wireless Telegraph Company has 27 shore stations on the Atlantic Coast, 26 on the Pacific and seven on the Great Lakes. One hundred marine equipments are maintained by the U. S. Government in the navy, army, revenue cutter and lightship service.

Two new telephone cables under San Francisco Bay are being laid to connect San Francisco and Oakland, California. The Home Telephone Company is employing six miles of cable weighing 600,000 pounds and the Pacific Telephone & Telegraph Company has ordered 16,300 feet of paper-insulated marine telephone cable to be stretched 9500 feet between San Francisco and Goat Island and 7800 feet from there to the Oakland Mole and containing 69 pairs of wires.

New telephone facilities on the Isthmus include a 100-drop common battery and a 20-drop magneto combination switchboard at Gatun and a 60-drop common battery and 60-drop magnetic combination switchboard at the Culebra exchange. The wire chief headquarters have been moved from Colon to Culebra which is now the main trunking point of the entire telephone and telegraph system of the Panama Railroad Company. The permanent telephone line will parallel the relocated track of the railroad.

An electric fog signal at Guernsey, England, will be worked from the shore. The plant consists of two Crossley oil engines, each driving an alternator, and a duplex compressor. In the lighthouse, 1¼ miles from the shore, are two compressors, direct coupled to motors, the current being conveyed by a submarine cable from the generators on shore. The switchgear is arranged so that either compressor can be set in motion from the shore station by means of a special switch. The compressors on the rock are fitted with a special oiling arrangement to enable them to run for several days without attention, as in rough weather it is impossible for an attendant to get out to the rock.

Comparative telephone costs are shown in a statement of the Panama Railroad Company that during a period of 24 hours, from 7 a. m., May 10, to 7. a. m., May 11, there was a total trunk line mileage of 135,180 miles transmitted through the various exchanges comprising the system. In addition, there were 7804 local calls handled during the same period. The standard commercial rate charged for toll line service in the States is 2-3 cents per mile, while the cost covering all construction, maintenance and operating charges of the department on the Isthmus, shows a comparative rate of approximately $.0015 per mile. Between the hours of 10 a. m. and 11 a. m. on May 10, approximately 18,000 trunk line miles were operated and on the basis of 2-3 of a cent per mile the charge would be $120. The actual cost upon the Isthmus was but $28. The average cost per local call was approximately $.0075, the greatest number of local calls being between 4 and 5 p. m., when 925 were transmitted through the various exchanges.

Yellow pine for telephone poles was the subject of a series of tests in preservative treatment by the Forest Service. This tree has a number of qualities which make it a desirable pole timber, but it is not durable, and decays at the butt in a few years, when set without being given a preservative treatment. An experimental plant was operated near Fresno, California, in which about 600 poles were treated. It was found that the western yellow pine ranks among the woods which are most easily impregnated with preservatives; and that when thoroughly seasoned, a penetration of from two to three inches was obtained by immersing the butts of the poles in a tank of hot creosote for a period of one hour, followed by five minutes' immersion in cold creosote. Owing to the ease with which it absorbs the preservative, western yellow pine is admirably adapted for treatment by the open-tank process. Since the treatments can be conducted with comparatively simple and inexpensive apparatus, it seems certain that the pine pole with creosoted butt will replace the cedar pole in many localities, as soon as its advantages are more commonly recognized.

PERSONALS.

C. C. Hillis of the Electric Appliance Company, San Francisco, has returned from a trip East.

Elam Miller of the engineering staff of the Pacific Telephone and Telegraph Company is at Seattle.

H. J. White, manager of Keeler, White & Company, Incorporated, San Francisco, spent the past week in Los Angeles.

J. A. Cranston of the Portland, Oregon, office of the General Electric Company spent several days of last week in San Francisco.

Otto Allmen Berger of the Berger-Carter Company of San Francisco has returned from a business trip of two months in the East.

Geo. C. Scoville, in charge of the San Francisco offices of the Dean Electric Company is in the Santa Ynez Valley, Santa Barbara County, Cal.

Walter B. Gump, recently of Los Angeles, is now permanently located at Tacoma, Wash., engaged in general mechanical and electrical engineering.

Ralph L. Phelps, in charge of the business of the Safety Insulated Wire & Cable Company on the Pacific Coast returned July 4th from a four weeks trip through the East.

The many friends of John R. Cole of San Francisco will be gratified to know that he has at last made the purchase of a complete set of golf clubs; this set includes a niblick of the most approved pattern.

Newly elected members of the executive committee of the San Francisco Section A. I. E. E. are C. W. Burkett and S. J. Lisberger for the two year term and Geo. R. Murphy, H. W. Clapp and Wynn Meredith for the one year term.

John G. Sutton of the John G. Sutton Company, San Francisco, leaves today for the Northwest; his trip in that section to include Portland, Vancouver and Seattle. From Seattle he will leave for an extended tour through the East, returning in about six weeks by way of New Orleans.

H. B. Squires of Otis & Squires, San Francisco, accompanied by A. W. Vincent, Pacific Coast Sales Engineer for the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., left for a trip to the Northwest on July 3rd; their trip will be an extended one and special attention will be given to the Cutler-Hamner line of specialties.

William Algernon Brackenridge has resigned as a member of the Advisory Board of Consulting Engineers of the new barge canal in New York to take the management of the Edison Electric Company, of Los Angeles, Cal. Mr. Breckenridge is well known as a hydraulic engineer, and the company of which he assumes charge derives almost all of its power from hydro-electric plants. It operates two stations on the Santa Ana river, two on Mill creek, one on Lytle creek and one on Kern river. The company has about 600 miles of transmission lines and operates at 33,000 and 60,000-volt primary and 10,000-volt secondary.

Recent registrations at the headquarters of the Northwest Electric Light and Power Association in Machinery Hall, A. Y. P. Exposition, Seattle, include J. H. Whitaker, Seattle, Seattle-Tacoma Power Company; A. S. McAllister, New York, Electrical World; G. A. Boring, Seattle, General Electric Company; A. B. Contles, Seattle, General Electric Company; J. M. Kinkaid, Port Townsend, Wash., Citizens Electric Company; Carl Remschel, A. I. E. E., Seattle, Allis-Chalmers Company; A. F. Dohn, Tacoma, Wash., T. R. and P. Co.; G. O. Snider, Tacoma, Wash., Puget Sound Electric Company; B. J. Cash, Jr., Portland, Ore., General Electric Company; H. Webber, Seattle, Wash., Watts Fixture Company; F. B. Lushington, Tacoma, Wash., Seattle-Tacoma Power Company; G. W. Arrowsmith, North Yakima, Wash., Northwest Light & Water Company; W. S. Stothoff, New York City, American Locomotive Company; Convers J. Smith, San Francisco, Cal., Standard Gas Engine Company; J. A. Cranston, Portland, Ore., General Electric Company; Allen E. Ransome, Seattle, Wash., Westinghouse Electric & Manufacturing Company.

CHANGE IN MANAGEMENT OF THE WESTERN ELECTRIC COMPANY.

P. H. Coolidge, manager of the Western Electric Company at San Francisco, who also occupies the position of district supervisor for the company on the Pacific Coast, which includes supervision of the Western Electric houses at San Francisco, Los Angeles, Seattle and Salt Lake City, will sever his connection with that company under date of July 15th to accept the position of assistant general manager of the Pacific Telephone & Telegraph Company with headquarters at San Francisco.

Mr. Coolidge took up his present work on the Pacific Coast in April, 1908, and since that time has made many warm friends, all of whom will be gratified to know that this change is along the lines of advancement in the class of work in which he is particularly interested.

The new manager to succeed Mr. Coolidge has not yet been selected; F. H. Wilkins, manager of the New York house and supervisor of the Eastern district, will be in San Francisco on July 14th to take charge temporarily with a view to looking over the field and suggesting such plans for reorganization on the Coast as conditions may seem to make advisable.

BOOKS RECEIVED.

Through the Yukon and Alaska. By T. A. Rickard; 392 pages, 6x10, 200 illustrations, 9 maps. The Mining and Scientific Press, San Francisco. Price, $2.50.

Vivid description of a latent land and a primitive people is herein graphically presented by an engineer and a writer whose name vouches for the interest of his observation. The author possesses the rare ability of imparting more information in an attractive form than most people would gather from a personal visit. The reader is carried from San Francisco through the mining regions of Alaska by a series of pen pictures, supplemented with fine photographs, and interspersed with anecdotes and historical references. This is probably the best description of conditions existing today in this little known empire of the north, and is well worth the perusal of anyone desiring to learn of the scenery, the people and the industries of this vast region. It is particularly interesting to note that much of the first authentic information regarding this country resulted in a survey made in 1863 by the Western Union Telegraph Company, who were proposing to connect America and Europe by way of Asia at a time when the submarine cable was believed to be impracticable. The book is non-technical and will be of interest to the general reader.

The Design and Construction of Induction Coils. By A. F. Collins; 272 pages, 5½x9, 155 illustrations, numerous tables. Munn & Company, New York City, and the Technical Book Shop, San Francisco. Price, $3.00.

This text begins with explanation of the rudiments of electricity and is adapted primarily to the needs of amateurs, many of whom are making induction coils and lack elementary knowledge. The exhaustive treatment and the numerous practical tables and diagrams presented make this book of value where the numerous smaller texts are too often lacking. Different coils varying from ½-inch spark to 12-inch spark capacity and included in three specific designs are described in every detail, so as to enable any one to construct them. Necessarily the work is largely one of compilation, although the chapters on the vacuum drying and impregnating processes, the making of adjustable mica condensers, and the construction of interlocking reversing switches are novel.

NEWS OF THE STATIONARY ENGINEERS.

PREAMBLE.—This Association shall at no time be used for the furtherance of strikes, or for the purpose of interfering in any way between its members and their employers in regard to wages; recognizing the identy of interests between employer and employe, and not countenancing any project or enterprise that will interfere with perfect harmony between them.

Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the business of the Association, and at all times preference shall be given to the education of engineers, and to securing the enactment of engineers' license laws in order to prevent the destruction of life and property in the generation and transmission of steam as a motive power.

California.

No. 1. San Francisco. Thurs., Central Hall, 933 Market St. Pres., J. W. Maher. Sec., A. T. Peery, Engine Room, P. O. Bldg.
No. 2. Los Angeles. Fri., Eagles' Hall, 116½ E. Third St. Pres., Gabriel Allen. Fin. Sec., Harry Notthoff, 1307 Winfield St. Cor. Sec., W. T. W. Curl, 4103 Dalton Ave.
No. 3. San Francisco. Every Wed., Merchants' Exchange Bldg. Sec., David Thomas, 914 O'Farrell St.
No. 5. Santa Barbara. Geo. W. Stevens, 2417 Fletcher Ave., R. R. No. 2.
No. 6. San Jose. Wed. Pres., W. S. Pierson. Sec., Leal Davis, 350 N. 9th St.
No. 7. Fresno. Pres., J. F. Wagoner. Sec., F. J. Whitney, Box 8.
No. 8. Stockton. Thurs., Masonic Hall. Sec., S. Bunch, 626 E. Channel St. Pres., Jos. Gieger.

Oregon.

No. 1. Portland. Wed., J. D. Asher, Portland Hotel. Pres., O. H. Reed.
No. 2. Salem. A. L. Brown, Box 166.

Washington.

No. 2. Tacoma. Fri. 913½ Tacoma Ave. Pres., Geo. E. Bowman. Sec., Thos. L. Keeley, 3727 Ferdinand St., N., Whitworth Sta.
No. 3. Walla Walla. 1st and 3d Wed., German Hall. Pres., W. M. Quinn. Sec., O. L. Compton, Box 11.
No. 4. Spokane. Tues. Pres., Grant Tuttle. Sec., J. Thos. Greeley, 0601½ Cincinnati St.
No. 6. Seattle. Sat. 1420 2nd Ave. Pres., J. H. Beckman. Sec., J. C. Miller, 1600 Yesler Way.

MEETING OF SAN FRANCISCO NO. 1.

San Francisco No. 1, N. A. S. E., at its meeting of July 1st, installed the following officers for the ensuing year: President, A. C. Arbuckle; vice-president, P. L. Ennor; recording secretary, Herman Noethig; financial secretary, J. M. Wilson; treasurer, D. Daniels; conductor, John McCaul; doorkeeper, F. H. Cherry; trustees, O. W. McCarthy, Conrad Wetzel and Charles Magnin.

The retiring president, John W. Maher, was the recipient of a beautiful gold chain and locket, which was presented by the association in appreciation of his services in the president's chair for the past two years. The presentation was made in a very fitting and impressive speech by Vice-President P. L. Ennor.

President Arbuckle appointed the following named educational committee for the current year: John W. Maher, steam engineering; Fred H. Kuhl, electricity; P. L. Ennor, refrigeration.

The educational committee have not yet completed their plans for the year's work, but several lectures are in preparation for the near future, subjects of which will be announced in a few days.

The success of the recent Mechanics' Fair and convention with its attendant publicity has resulted in a large increase of applications for membership. It is the intention of the association to devote an evening in the near future to the examination and initiation of candidates, and for this reason applications which have been recently received are being held over and will be all set for the same night.

Past President John W. Maher has been appointed librarian. The books on hand are to be rearranged and catalogued and a number of new volumes added to bring the library up to date.

MEETING OF SAN FRANCISCO NO. 3.

San Francisco No. 3, N. A. S. E., held an important meeting on June 30th, the principal business being election of officers for the ensuing term, and election of delegates and alternates to the National Convention at Columbus, Ohio, in September.

The officers are now: W. N. Munro, president; C. E. Van Meter, vice-president; David Thomas, secretary; Chas. Knights, financial secretary; Chas. Dick, treasurer; F. A. Brewer, conductor; John Hanna, doorkeeper; Gustav Lienau, John Traynor and J. M. Lawrence, trustees. The delegates are C. E. Van Meter and J. M. Lawrence; alternates are J. B. Williams and W. G. Talbot.

Since the conclusion of the highly successful Mechanics' Fair many local engineers have applied for admission to the N. A. S. E. and No. 3 looks forward to a banner year, the membership being higher now than at any time since its inception in 1901. The educational features promise to be of exceptional interest, as the educational committee have prepared a lengthy program on various topics of interest to the profession.

PROGRAM FOR NATIONAL CONVENTION WEEK.

The program for the national convention week of the N. A. S. E. in Columbus, Ohio, is as follows:

MONDAY, SEPTEMBER 13.

9 a. m. Opening of the annual convention of the Ohio State Association, N. A. S. E. on roof garden of the Southern Hotel.

Registration of delegates to the national convention in rooms of the credential committee at the Southern Hotel. The registration bureau will be open all day and evening.

1 p. m. Official opening of the Mechanical Exposition of the National Exhibitors' Association in Memorial Hall.

2 p. m. Session of Ohio State Convention.

8 p. m. Reception to the delegates and guests at the Southern Hotel.

TUESDAY, SEPTEMBER 14.

10:30 a. m. Introductory exercises of the N. A. S. E. national convention in Board of Trade Auditorium, Charles M. Gilbert presiding.

Invocation by Rev. Washington Gladden, D. D.

"Welcome to Ohio," by Governor Judson Harmon.

Response to Governor Harmon, by National President Fred J. Fisher.

Address by Joseph F. Carney, Past National President, N. A. S. E.

"Welcome to Columbus," by Mayor Charles A. Bond.

Response to Mayor Bond, by National Vice-president William J. Reynolds.

1:30 p. m. First business session of the national convention (all sessions will be held in the Board of Trade Auditorium).

2:30 p. m. Opening of the annual national convention of the Ladies' Auxiliary, at the Southern Hotel.

7:30 p. m. Annual meeting of the Life and Accident Department of the N. A. S. E. at Southern Hotel.

8:30 p. m. Entertainment by the Ladies' Auxiliary of Columbus.

WEDNESDAY, SEPTEMBER 15.

9:30 a. m.. Trolley trip to the new city water filtration and softening plant.

1:30 p. m. Cars leave Southern Hotel for Olentangy Park, where amusements and theatre attractions will be open to all delegates and guests. The evening program will be announced later.

Badges furnished by the credential committee will admit to all entertainments during convention week. Car tickets to Olentangy Park will be furnished in the hotel lobby by the Local Convention Committee during the day.

THURSDAY, SEPTEMBER 16.

9. a. m. Convention session of the N. A. S. E.

9 a. m. Convention session of the Ladies' Auxiliary (all sessions at the Southern Hotel).

2 p. m. Convention session of the N. A. S. E.

2 p. m. Automobile trip through city parks for the Ladies' Auxiliary.

8:30 p. m. Entertainment by the "New York Bunch," in Memorial Hall.

FRIDAY, SEPTEMBER 17.

9 a. m. Convention session of the N. A. S. E.

9 a. m. Convention session of the Ladies' Auxiliary.

2 p. m. Convention session of the N. A. S. E.

2 p. m. Ladies will install newly elected officers.

3:30 p. m. Ladies' Auxiliary will visit the Relic Room in the State Capitol.

8 p. m. Installation of newly elected N. A. S. E. national officers in the U. C. T. Hall, High and Goodale streets.

9. p. m. Grand ball in U. C. T. Hall.

SATURDAY, SEPTEMBER 18.

Delegates and guests will be welcome at the various power plants and places of interest in and about the city.

Note: The Mechanical Exposition in Memorial Hall will be open each day, commencing Tuesday of convention week, from 10 a. m. to 10 p. m. Aside from a notable array of exhibits, there will be music by a first class band and two organ recitals.

FOSTER SUPERHEATERS.

The great advantage from a mechanical and economical standpoint in using superheated instead of saturated steam for operating steam engines, or for carrying steam through long lines of pipes for preventing condensaton of steam in pipes, or getting a high temperature in various forms of kilns, ovens and drying plants generally, has been so generally recognized in recent years that the Foster Superheater, built by the Power Specialty Company, New York, has become well known throughout the United States, where installations amounting to approximately a million horsepower have been made. Not being allied with any particular make of boiler, it is found in combination with all standard types on the market. It may be installed with old or new plants with equal facility.

All steel construction is used for pressure parts. The heating surface is made of composite elements consisting of cold drawn steel tubes forming the body, and a covering of cast iron with deep corrugations on the external surface. These coverings are shrunk on the tubes in such a manner as to completely envelop and protect them from the action of the hot gases, while at the same time the heat-absorbing surface is greatly extended and the efficiency of the apparatus thereby increased.

A large number of prominent plants are equipped with Foster Superheaters, including practically all of the United States Navy Yards, central power stations in many of the large cities of the country, including a 6000-horsepower plant of the Oakland Gas, Light and Heat Company, two permanent power plants for the Panama Canal, and numerous small installations for nearly every variety of mechanical industry.

A SAN FRANCISCO PRODUCT ADOPTED IN PHILADELPHIA.

The Butte Engineering and Electric Company of San Francisco have just closed a contract with the Philadelphia Traction Company through Thomas J. Ryan, president, amounting to several thousand dollars covering twelve electromagnetic brakes to be used on high speed cars of the Philadelphia system operated at an approximate speed of forty miles per hour.

This device was designed and manufactured in San Francisco and the decision to place the contract at this point was based solely on the question of merit.

MEETING OF CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION.

The California Independent Telephone Association held its regular quarterly meeting June 12, at Los Angeles, to elect officers for the coming year and to hear reports of the past year's work.

The officers elected were: President, Arthur Wright, Los Angeles; first vice-president, D. S. Parker, Pomona; second vice-president, E. P. Morphy, Los Angeles; secretary, A. Wardman, Whittier; treasurer, W. L. Frew, Compton; executive committee, J. D. Holmes, Pasadena; C. H. Temple, Los Angeles; A. E. Madison, Santa Barbara; J. O. Houser, Covina; advisory board. A. B. Cass, Los Angeles; K. C. Wells, Redlands; F. A. Powell, San Fernando, and Albert Skalowski, Santa Monica.

PACIFIC STATES ELECTRIC COMPANY.

We noted briefly in our issue of July 3d the consolidation of the Sterling Electric Company, San Francisco, the Brooks-Follis Electric Corporation of San Francisco, the Pacific Electrical Works of Los Angeles and the Crescent Electric Company of Oakland, under the name of the Pacific States Electric Company.

This company has since been incorporated under the above name with a capital stock of $500,000, the incorporators being W. L. Goodwin, Frank Fowden, John S. Eells of San Francisco, H. V. Carter of Los Angeles and C. L. Gilson of Oakland. Mr. Carter is expected in San Francisco the latter part of this week when it is expected that the incorporated company will be organized and a board of directors and officers chosen.

TRADE NOTES.

The Cook Electrical Construction Company have moved their office from the sixth to the fourth floor of the Columbia Building, Spokane, Wash.

The Austin-McCain Company, electrical dealers of Spokane, Washington, announce the removal of their business from 306 Post Street to the Odd Fellows' Building, Main and Wall Streets, Spokane.

Notice has been received that the Central Colorado Power Company, the Eastern Colorado Power Company and the Leadville Light & Power Company have removed to their permanent offices, 1210 Seventeenth Street, Denver, Col.

Mathias Klein & Sons of Chicago, manufacturers of line construction material, have completed an arrangement with Otis & Squires of San Francisco under which that firm will until further notice represent them on the Pacific Coast.

Reports from Chicago say that buyers of electrical apparatus are not only talking in a more encouraging way, but they are actually making purchases of machinery and supplies in considerable quantities. One indication of the truth of this statement is the fact that, during the month of June, 11 turbo-generator sets of good size were sold by the Chicago offices of the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company.

The Pennsylvania Tunnel & Terminal Company, operating the Pennsylvania Railroad tunnels under New York City and the rivers, is installing in its Long Island City power house two Westinghouse turbine-alternator sets of 2500 kilowatts capacity each, for lighting the tunnels and terminals. The dependability required in this service has demanded that every precaution be taken to insure absolute continuity of operation of the generating and distributing systems. The alternators will supply three-phase, 60-cycle current at 440 volts.

Four 13x12 inch, three-cylinder Westinghouse gas engines, direct connected to Root position blowers, are being installed by the Public Service Corporation of New Jersey, at its Hoboken and Passaic gas plants, for the purpose of boosting the gas pressure in the mains. The engines are of the vertical type, develop 90 horsepower each, and utilize illuminating gas for fuel. This application of gas engines to raising the pressure in gas lines is one that is attracting much favor among the officials of the public service corporations, and it is expected that the future will see a great many similar installations for this work.

The Harvard Electric Company, 136 Liberty Street, New York, N. Y., and 66 W. Van Buren Street, Chicago, Illinois, are requesting the trade to take notice of the fact that any manufacturing concern, other than the Harvard Electric Company, offering "hook type" sectional switch boxes constructed as per those illustrated in the Harvard catalog, are offering an infringement of Harvard patent sectional boxes.

The Harvard Electric Company claim to be the sole owners of patents issued covering the construction of sectional boxes that "hook" together, as shown in their catalog and the trade is cautioned against purchasing, using, or vending the infringing product.

Fredric Greer, president of the Harvard Electric Company requests the trade in a spirit of fairness and as a matter of protection, to purchase only the guaranteed article, which can be identified by the Harvard trademark on every box of their product.

A review of the business now being done by the General Electric Company and the Westinghouse Electric and Manufacturing Company, made by a New York financial paper, estimates that in 1909 the former will do a business of about $53,000,000, and the latter a business of about $25,000,000. Speaking of the present condition of these companies, the review says: The General Electric and Westinghouse companies are now well fortified from the standpoint of working capital, and they can engage in large enterprises without assistance from banking institutions. As an illustration, the General Electric Company on January 31st last reported cash holdings of $22,234,000, which is almost twice the amount held the year previous. The company has a working capital of approximately $57,000,000. The Westinghouse Electric & Manufacturing Company, as a result of the reorganization, is stronger from the standpoint of cash and working assets than at any time in its history. It recently reported cash holdings of close to $13,000,000." The General Electric Company, it is stated, now has a floor space of 7,000,000 square feet, and employs 23,000 hands.

NEW CATALOGUES.

The Western Electric Company are distributing monthly calendars illustrating the various opportunities for the use of Hawthorne Fan Motors. It includes a detachable postal which can be returned to them as a request for information on the subject.

The Pacific Electric Heating Company of Ontario, Cal., are celebrating the completion of the first year of their snappy little publication "Hot Points," which is printed monthly for men electrically interested. It is a bright and sunny little publication and a good antidote for the pessimist.

The General Electric Company has just issued Bulletin No. 4670 covering gaskets and bell mouths for conduit wiring, marine railway car equipments and underground circuits. The illustrations in the bulletin consist of dimension diagrams of the soft rubber gaskets and metallic bell mouths, and a complete set of tables enables the customer to determine the size of bell mouths required for any particular service, and to readily ascertain the proper gasket which should be used with it.

The Allis-Chalmers Company are distributing a neatly printed folder No. 4019 descriptive of the Pacific Coast offices of that company, which includes some very handsome illustrations of their houses at Los Angeles, San Francisco and Seattle, together with a complete list of their products and a few words regarding their good qualities.

The General Electric Company has just issued a bulletin, No. 4664, devoted to a new line of direct connected engine-driven railway generators, Form S, which embodies a number of improvements over previous types. The standard line of these generators range in capacity from 100 k. w. to 2700 k. w., and the speeds have been carefully selected to adapt the generators for direct connection to steam engines. They are designed to run at constant speed, and for the prevailing full load railway voltages.

The Tungstolier Company of Cleveland, Ohio, experts on scientific illumination, recently issued a souvenir booklet which was prepared for distribution at the convention of the National Electric Light Association at Atlantic City and has been very generally distributed since. It is a beautiful little brochure in the form of a folder of four panels, the title being "The Luminaries," and treats of The Stars, The Moon, The Sun and The Tungstolier and their relations to the lighting problem. It is a beautiful conception artistically carried out.

The General Electric Company's Bulletin No. 4661 is devoted to aluminum lightning arresters for alternating-current circuits of from 4600 to 110,000 volts. The arresters are built up of a number of aluminum plates immersed in an electrolyte. An hydroxide film on the surface of the plate allows a low current flow up to a certain voltage, and at a higher voltage the flow is limited only by the internal resistance of the cell which is stated to be very low. The arresters have large discharge capacity and take care of continuous and recurrent discharges.

The B. F. Sturtevant Company of Hyde Park, Mass., has issued Bulletin No. 106 describing its ready-to-run fans for household and other uses. The fans are of the multivane type, each fan wheel being made up of 60 spooned blades and attached to the shaft of a direct-current or alternating-current motor. The three sizes exhaust 150, 300 and 450 cubic feet of air per minute and weigh 25, 35 and 50 pounds respectively. The outfits are applicable for ventilating rooms and offices and may also be used for blowing furnaces during the winter months.

The Dearborn Drug and Chemical Works, Chicago, Ill., has issued a pamphlet, entitled "Lubrication Versus Friction." This contains a description of the various lubricants manufactured by the Dearborn Company, giving the gravity, flash point, burning point, viscosity and application, in each case. The greater part of the pamphlet is taken up with a study of lubricants in general, the art of lubrication, and the various methods for testing lubricants, with a description of the instruments employed. No user of lubricants should fail to obtain a copy of this useful publication, which contains a considerable amount of useful practical information in a most convenient, compact and accessible form.

The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has prepared an attractive little folder, "Electric Power for Domestic Purposes," which offers many valuable suggestions for the use of small motors in the home. Among the labor-saving applications of electric power noted are the sewing machine, vacuum cleaner, washing machine, ice-cream freezer, coffee grinder, meat chopper, ironing machine, silver polisher, dish washer, and the motor-driven pump. A novel electric-driven household utility illustrated in the folder is the combination of a coffee grinder and meat chopper compactly attached to a small motor. The booklet "Electric Power for Domestic Purposes" will be sent upon request.

INDUSTRIAL

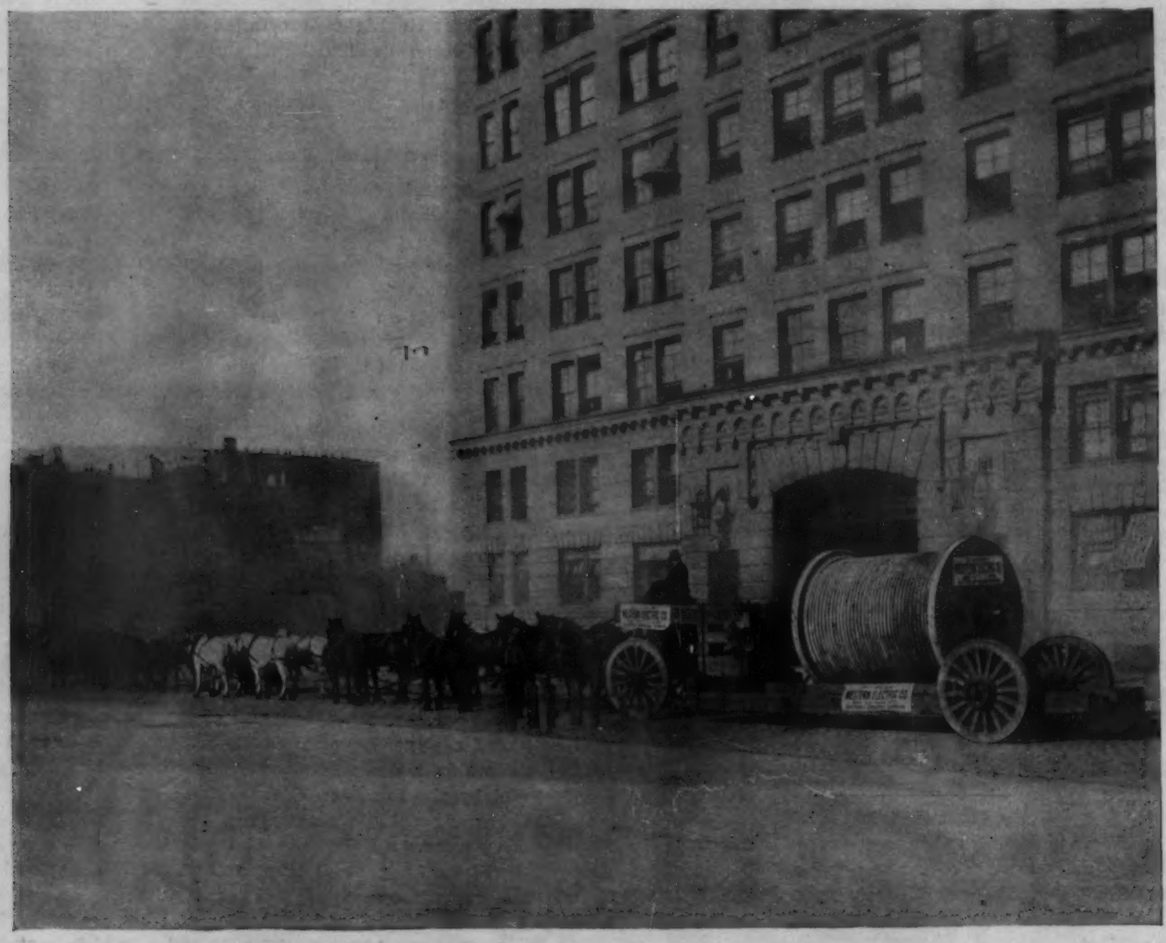
A MONSTER CABLE.

On Tuesday, June 8th, the Western Electric Company of New York City shipped the first section of a submarine telephone cable designed to connect San Francisco with Oakland, by way of Goat Island, beneath the waters of San Francisco Bay. The cable is 2⅞ inches in diameter, containing 69 pairs of telephone wire, 26 pairs of No. 13 B. & S. and 43 pairs of No. 19 B. & S. On the big reel the first section, 4250 feet in length, weighed 26½ tons.

The truck on which this cable was hauled weighed about five tons, and sixteen horses dragged the heavy load. The wagon was built very low, with a clearance of only eight inches between its lowest part and the ground. Guiding eight teams of horses through the streets of New York and around the narrow corners is an unusual sight as well as a difficult task, and many looked in wonder at the cavalcade as it made its way along Bethune street from West street to Eighth avenue, thence up to Twenty-seventh street and west to the river, where the freight dock of the Lehigh Valley Railroad is located.

The second consignment of 4250 feet left the Western Electric Company's factory in the same manner two days later.

The first two sections of this cable, 8500 feet altogether in length, are to extend from San Francisco to Goat Island. When the other two sections of 7800 feet arrive, they are to be stretched from the island to the Oakland Mole. On Goat Island, connection with land cable is to be made. The entire 16,300 feet of cable is one of the largest orders for paper-insulated submarine telephone cable ever placed. The cable is consigned to the Pacific Telephone and Telegraph Company.



Monster Cable Leaving New York Building of the Western Electric Company.

REPEATING COILS FOR PHANTOM CIRCUITS.

The problem of building additional toll and rural circuits to handle a constantly increasing business is one of the most serious difficulties that is today presenting itself to the independent telephone operators. The fact that in the number of local subscribers independent operators far outnumber their competitors is sufficient indication of the fact that the requirements for independent toll service are correspondingly larger.

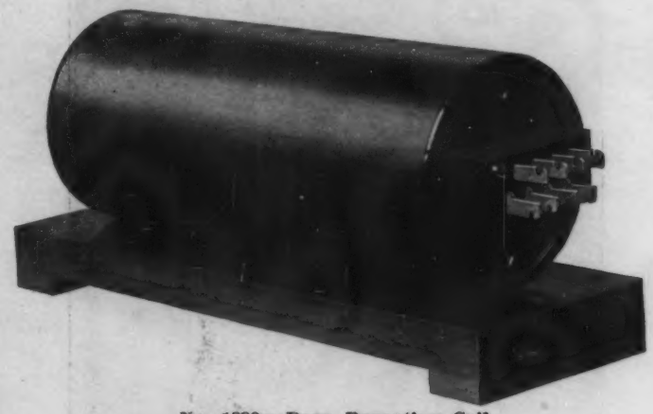
To meet this need, independent engineers have been foremost in the developmnt of "phantom" circuits. By the use of ingeniously devised coils an imaginary circuit, of even greater efficiency than the actual physical circuit, is created without any additional outside wiring.

These additional circuits are built up by the use of a repeating coil manufactured by the Dean Electric Company and sold as their No. 1620 coil. A metallic line with two of these Dean coils will make a ground return phantom circuit or a total of two talking and signaling circuits. By using two coils and three wires, two metallic circuits can be obtained. Two metallic lines with four Dean coils make a

metallic phantom or a total of three talking and signaling circuits without grounds. This increase may be effected proportionately to the increase in the number of metallic physical circuits used.

As shown in the illustration, the Dean No. 1620 repeating coil is enclosed in a seamless iron tube 5¾ inches long and 2½ inches in diameter with a maple base 7 inches long and 2½ inches wide.

The manufacturers claim that the coil is absolutely cross-talk proof even when several are mounted side by side. A large number of turns of unusually heavy wire materially increases the efficiency and the use of Swedish iron core wire,



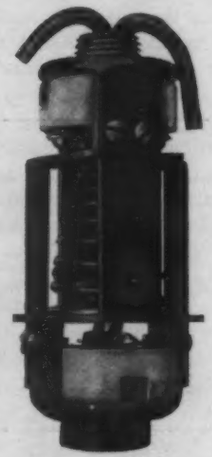
No. 1620. Dean Repeating Coil.

which is especially annealed, raises the permeability and decreases hysteresis and eddy current losses. Much of the efficiency of such a coil depends upon the perfection of the magnetic circuit. Further claims of the manufacturers state that the magnetic properties of the Dean No. 1620 repeating coil are absolutely accurate.

In the construction of phantom circuits, it is necessary to transpose the outside wiring. The problems arising in this connection have been thoroughly studied by the manufacturers' technical men. It is a peculiar fact that the phantom circuit, created by adding Dean coils to two metallic lines, is more perfect than either of the two physical circuits.

TUNGSTEN LIFE-SAVER.

This is a new device for the prevention of injurious shocks from vibration, and is being placed on the market



Tungsten Life-Saver

by the American Arc Lamp Company, Specialties Department, Kalamazoo, Michigan.

This device is placed at the ceiling and protects the entire fixture from shocks, and thus keeps the effects of vibration as far removed from the lamps as possible. It is very sensitive and admits of a lateral or oscillating motion within limited area. It is connected to the ceiling by means of an ordinary crowfoot, and when installed in steel buildings an insulating joint may be used instead. It will fit any standard fixture or cluster and is made in suitable strengths to sustain fixtures weighing from four to fifteen pounds or more. Connection with conduit is easily made. The Tungsten Life-Saver is packed in separate cartons with full instructions.

TUNGSTEN SHOP CLUSTER.

Following their established plan of making shop and factory lighting a specialty the American Arc Lamp Company, Specialties Department, Kalamazoo, Mich., have placed on the market an inexpensive shop cluster, either three or four light.

This cluster is made entirely of steel, and is equipped with an 18-inch steel, porcelain enameled shade. A special feature is the light distributing cone extending down from

Tungsten Shop Cluster

the center of the receptacle plate to a point about midway of the lamps. This cone is enameled white porcelain and tends to deflect the light downward and outward into the proper zone. It also serves to prevent one lamp from absorbing the light of another. Arrangement is made for a pendant switch if desired. This cluster may be used with or without the Tungsten Life-Saver as desired.

OLD DUTCH CLEANSER USING ELECTRIC SIGN.

The Cudahy Packing Company of Omaha, Neb., is using an electric sign to advertise Old Dutch Cleanser in its home town. The sign is 38 feet high by 54 feet long. It has the advantage over the magazine page in that it is animated. It is operated by a Reynolds-Dull high-speed flasher, which produces the following effect: First, Woman and one club; second, Old Dutch Cleanser; third, Chases Dirt; fourth, Arm and stick action. The sign remains on for a short period as a whole, then the performance is repeated.

This is the first electric sign ever used by the Cudahy Packing Company and they are enthusiastic over the results so far obtained. It is situated in the heart of Omaha and is attracting much favorable attention.

The sign was built and erected by the Thomas Cusack Company of Omaha and the Omaha Electric Light and Power Company is furnishing current.

"THE TALL MAN AND THE SHORT MAN."

In every city of any size in this country where "holdups" are of frequent occurrence the criminals are generally described as the "tall man and the short man"—they always appear to travel in pairs of this kind.

The Dean Electric Company of Elyria, Ohio, manufacturers of Dean Telephone material have in their selling organization a pair of "holdup" men of the "tall and short" variety although their holdups are of a peaceful and not a criminal character.

M. J. Corwin
5 ft. 1 in.
Dean Representative in Seattle

W. S. Williams
6 ft. 4 in.
Dean Representative in Minnesota

W. S. Williams, their representative in Minnesota, is the tall man and M. J. Corwin, their Seattle representative, is the short one. Mr. Williams is 6 feet 4 inches and Mr. Corwin 5 feet 1 inch in height. Their weight is not given but the Dean Company claims that the little fellow makes the big boy hustle to sell more Dean apparatus.

WESTINGHOUSE ELECTRIC MINE INSTALLATIONS.

Among some recent notable installations of electrical machinery by the Westinghouse Electric and Manufacturing Company, in the mining territory of several Western States, there may be noted the following:

The new blower house of the Washoe Smelter of the Anaconda Copper Mining Company, at Anaconda, Mont., contains four 600-horsepower motors driving Root blowers, and two additional 600-horsepower slow-speed motors driving high-pressure air compressors for pneumatic-locomotive service.

The turbine plant of the Helena Power Transmission Company, Butte, Mont., is a Westinghouse installation. This supplies the local Butte mines in parallel with a 70,000-volt, 85-mile transmission line, and has performed some remarkable overload and emergency service.

The pumping station at the Leonard mine of the Boston & Montana C. C. & S. M. Company, 1200 feet underground, contains two 300-horsepower couples of two 150-horsepower motors, each direct-connected to Nordberg pumps and supplemented by a similar 150-horsepower motor driving an Aldrich pump. The station, 1200 feet underground, is about 20 feet high, is lighted by arc lamps, and has a complete switchboard installation.

The semi-automatic relay-controlled hoist of the Modoc mine of the Anaconda Copper Mining Company, Butte, Mont., is also an interesting recent installation of the Westinghouse Company.

K & G DOUBLE BORING MACHINE.

The K & G Double Boring Machine for use in boring holes in upper or lower joists is now being manufactured and supplied by George Garretson, Eighth and F streets, San Diego, Cal. It is an electrician's two spindle machine designed with a special view to simplicity and ease of operation. Among other claims made for it by the manufacturer are that it will bore overhead or below, one or two holes at a time, through wood from two to four inches, for wiring or piping. The

K. & G. Double Boring Machine in Operation.

feeding of the bits is positive and voluntary and the instant withdrawal of the bits is easily accomplished. Over three hundred holes an hour can be bored with this device and knots are bored readily when in the line of wiring.

The design and construction of this machine calls for the best bicycle material throughout, the frame is finished in aluminum or bronze as may be ordered, and all sprockets are nickel plated. It is so simple in operation that a boy can handle it.

PROGRESS IN CUBA.

With the beginning of the present fiscal year the Republic of Cuba established a Bureau of Information, President Gomez appointing Leon J. Canova, an American newspaper man, who has resided in Cuba eleven years and has a wide acquaintance with the island, as its director.

Parties wishing information of any nature concerning Cuba can obtain same, free of charge, by writing to Leon J. Canova, U. and I. Bureau (Utility and Information Bureau), Department of Agriculture, Commerce and Labor, Havana, Cuba.

BOOK PUBLISHERS CONSOLIDATE.

Announcement is made of the consolidation of the book department of the McGraw Publishing Company and the Hill Publishing Company, New York, under the name of the McGraw-Hill Book Department, at 239 West 39th Street, New York City. The consolidated company began business under date of July 1st.

NEWS NOTES

TELEPHONES.

COEUR d'ALENE, IDAHO.—The Interstate Telephone company has begun improvements on its lines which will cost about $8000.

TACOMA, WASH.—The Home Telephone Company of Puget Sound is planning many improvements to its system, the probable cost being $100,000.

NORTHPORT, WASH.—The Farmers' Telephone Company has been organized and will install telephones all through the Deep Creek farming section.

HOQUIAM, WASH.—More than $10,000 will be expended rebuilding the entire telephone system of this city by the Pacific States Telephone & Telegraph Company.

BELLINGHAM, WASH.—It is understood that the American District Telegraph Company will secure a franchise for operating a burglar alarm, police call and messenger system in this city.

SEATTLE, WASH.—Frank Frerichs, manager of the local wireless telephone company, states that it is the intention of the company to establish a large factory here for the manufacture of wireless telephones.

SAN FRANCISCO, CAL.—Figures are now being taken by Architect C. A. Mathews of Oakland for a 1½ story telephone exchange building to cost $6000, to be erected in Fruitvale for the Home Telephone Company.

SAN FRANCISCO, CAL.—The Gamewell Fire Alarm Telegraph Company has been awarded the contract for furnishing 53 alarm boxes on its bid of $6250, lower bids being rejected on the ground that the Gamewell boxes would give the city the best service.

WINCHESTER, CAL.—The Winchester Pleasant Valley Telephone Company has been chartered to construct and operate local rural telephone lines to connect with the Home company's service. M. L. Howell is president of the new company and C. W. Patterson, secretary.

SAN FRANCISCO, CAL.—The Supervisors have adopted a resolution authorizing the employment of Prof. C. L. Cory as city expert to obtain data in regard to the Pacific States Telegraph & Telephone Company to be used in fixing the rates to be charged by the company. Cory's compensation is not to exceed $1200.

NAPA, CAL.—The forty odd residents along the Hagan and adjoining roads, who were recently granted a franchise to build a rural telephone line from this city to their homes, have organized the Imrieville Farmers' Telephone Company. The following directors were elected: W. G. Furber, E. S. Swan, E. N. Zettle, E. H. McMillan and Wm. McKenzie.

BOTHWELL, WASH.—The Independent Telephone Company has purchased property on Main street, and a substation is to be installed in the building which the company will erect. Several years ago a toll station was installed in this city but no local service was given. However, patronage has grown so large that the company deems it a good plan to install a local switchboard.

BREMERTON, WASH.—Bremerton and Kitsap county are to have a new telephone system to connect with the Independent company of Seattle. The company is to be known as the Kitsap County Telephone Company and exchanges are to be installed in all the principal towns of the county. C. J. Farmer of Port Townsend and W. D. Calder of Bremerton are the principal parties interested.

BELLINGHAM, WASH.—During the coming summer the Home Telephone Company will expend about $25,000 in improving its telephone system in Whatcom county. Five carloads of cables, wire and other equipment have been ordered. In Eureka additional cables will be installed to relieve the congestion in that portion of the city. It is reported that the lines of the Farmers' Mutual Telephone Company, connecting Bellingham with outside points will be double-trunked. New telephones are being installed on these lines and for that reason the improvement was a necessity. On Sylvan street wires will be placed underground, 400 pair cable being used.

WATSONVILLE, CAL.—Manager E. H. Cleveland of the local telephone exchange has received notification from the headquarters of the Pacific States Telephone and Telegraph Company that his recent estimate of $10,610.19 as the cost of improvements to be made in the Watsonville service has been approved. The underground system will be extended. The general plan will enable the company to place 1500 additional phones in service when needed, and undoubtedly will meet the demands of increased service for the next five or six years. Another step will be the erection near the present site of a new central exchange. This will be a modern concrete building 30x100 feet.

FINANCIAL.

RIVERSIDE, CAL.—The Trustees of El Centro have taken steps to call a bond election to vote on the proposition of issuing bonds for $75,000 for a municipal water plant.

DOUGLAS, ARIZ.—At the next meeting of the city council the question will be presented of calling an election to vote upon municipal water bonds in the sum of $325,000.

JACKSONVILLE, ORE.—At an election to provide amendments to the city charter empowering the city to issue bonds not to exceed $25,000 for a water system, the amendments carried by a vote of 102 to 2.

TACOMA, WASH.—The Tacoma Gas Light Company has been purchased by H. M. Byllesby & Co. of Chicago from E. M. Deane and associates of Grand Rapids, Mich. The new owners plan to spend $500,000 in extensions.

HONOLULU, H. T.—The $100,000 worth of bonds for the construction of the Kula pipeline on Maui will in all probability be handled in this city. It is undertsood that the Bank of Hawaii is prepared to take over the Kula bonds.

SAN FRANCISCO, CAL.—Treasurer McDougald has turned over to Frank Brown representing James H. Adams & Co., of Los Angeles, the 240 Hetch Hetchy bonds purchased last week and received in return $243,050 in gold coin the agreed purchase price.

ASHLAND, ORE.—A special election will be held Monday, July 19, to authorize the refunding of the $50,000 water works bond issue due July 1st. E. H. Rollins & Sons have offered to take the bonds in the amounts required. They are also arranging with the present holders of the bonds to carry the same over until the date of the election.

LODI, CAL.—The Supreme Court has decided that the election held for the purpose of voting bonds for light, water and sewage plants was legal. After the election had been held Edward Cary brought an injunction suit against the city to have the election declared invalid. He carried the suit up to the Supreme Court. It is the intention of the city officials to immeditely sell the bonds and build municipal plants to meet all the requirements of the city.

—SAN FRANCISCO, CAL.—Suit has been filed in the U. S. Circuit Court by the Marin Water and Power Company, successors to the Marin Water Company, to secure a permanent restraining order preventing the trustees of San Rafael from enforcing an ordinance passed June 21st fixing a water rate which, according to the complaint, is too low to afford a reasonable income to the water company.

SAN FRANCISCO, CAL.—A final installment that will complete a payment of nearly $2,000,000 for water power has been turned over to the Fleishhackers for their Truckee River Electric holdings, which they have sold to the California-Nevada Electric Power Company, of which W. P. Hammon of this city is the head. The payment of $1,000,000 is the consummation of a deal that has been pending for some time. Several months ago Hammon secured an option on the property and gradually made payments amounting to more than $800,000. The property consists of four large power plants on the Truckee river and a distributing system carrying electricty into Reno, Carson, Virginia City and other towns. It is Hammond's intention to spend more than $1,000,000 within the next year improving the system. The new company plans to build branches through all the mining districts of Nevada.

INCORPORATIONS.

CLAREMONT, CAL.—Valley View Water Company, capital stock $50,000; by G. R. Norton, president; D. R. Malone and Lulu A. Spier.

SAN FRANCISCO, CAL.—Pacific States Electric Company, capital stock $500,000; by W. L. Goodwin, F. Fowden, J. C. Gibson, H. V. Carter and J. S. Eells.

SAN FRANCISCO, CAL.—Lakeview Oil Company of Midway, capital stock $1,000,000; by R. G. Fernald, W. C. Webb, E. Schwab, W. I. Brobeck and R. C. Gurnett.

SAN FRANCISCO, CAL.—Cambria Oil Company, capital stock $2,000,000; by E. O. Allen, D. A. Dodge, Susan O. Harris, J. A. McCorkell and A. E. La Vau, 5 shares each.

SAN FRANCISCO, CAL.—The Hawaiian Oil Company, capital stock $25,000; by R. G. Fernald, E. Schwab, W. C. Webb, W. I. Brobeck and R. C. Burnett, 1 share each.

FRESNO, CAL.—Coalinga Great Western Oil Company, capital stock $250,000; by J. W. Short and B. Reinhold of Fresno, W. W. Sweet, Milton Feder and C. K. Bonestell of Coalinga.

BAKERSFIELD, CAL.—Obispo Oil Company; capital stock $50,000; by J. W. Barneburg, A. Luchessa, F. W. Vetterline, A. F. Fitzgerald, W. C. Smith, W. C. Oakley and G. M. Doane, all of San Luis Obispo.

COEUR d'ALENE, IDAHO.—Articles of incorporation have been filed by the Coeur d'Alene Current Motor Company. The directors are G. E. and J. R. Novers, C. M. Butlhor, F. E. Wonnacott and Guy Searles. The capitalization of the corporation is $250,000, and its purpose is to generate electricity for power and all uses.

TRANSMISSION.

CRANBROOK, B. C.—A fire at the Mayook Lumber Company's plant recently caused a loss of $60,000.

KENDRICK, IDAHO.—A franchise was granted to A. B. Richards and others for the erection and operation of a general electric light, heat and power system.

NORTH YAKIMA, WASH.—A. Moughin of Seattle announces that the interests which are backing him will within a year install a 10,000 h. p. electric plant here.

OAKLAND, CAL.—The Great Western Power Company is making extensive additions to the building and power plant on Fourth avenue near Trestle Glen. It is stated that the additions will amount to a doubling of the size of the buildings and the capacity of the plant.

INDEX, WASH.—J. A. Soderburg, proprietor of the Index Granite Works, has arranged with the owners of water rights at Sunset Falls to construct an electric plant there.

CHEHALIS, WASH.—The North Coast Railroad Company has appropriated considerable of the water of the headwaters of the Cowlitz River for power purposes and will build its power plant on Lake Frederick.

LOS ANGELES, CAL.—Captain Amos A. Fries of the U. S. engineer's office has under consideration the application of Edison Electric Company to build a high span power line over the channel between Wilmington and Long Beach harbors near works of San Pedro Salt Company.

SEATTLE, WASH.—The corporations committee of the city council has decided to recommend that all wires be placed under ground in the district from Yesler Way to Pine street, and from Post street to Fourth and Fifth avenues. Three years will be allowed to complete the work.

COALINGA, CAL.—Formal announcement has been made by the San Joaquin Light & Power Company that the electric line of this company is to be extended from Lemoore to Coalinga and the oil fields and a complete system of furnishing water from Armona is to be built at the same time.

CHEHALIS, WASH.—Claims for 500 feet of water have been filed in the County Auditor's office by the North Coast Railroad Company from Muddy Fork and the Ohanapecosh to be used in generating electric power. Lake Frederick is named as a reservoir site. It is proposed to generate 100,000 horsepower.

BELLINGHAM, WASH.—The North Coast Mining and Milling Company has filed notice of appropriation of 8000 cubic feet of water per second from the Skagit river in Whatcom county. A dam is to be erected and the water carried in flumes, pipe lines and tunnels to near Red Hill, where a hydro-electric power plant will be built.

ILLUMINATION.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company will soon extend its lines to Mt. Washington.

SAN JUAN, CAL.—The town board has accepted the bid of the San Benito Light & Power Company for a franchise through the town for the sum of $50.

LOS ANGELES, CAL.—The Board of Public Works will receive sealed bids up to 11 a. m. July 6th for furnishing transformers in accordance with specification No. 81.

SEATTLE, WASH.—One hundred thousand dollars will be appropriated to commence work on the extension of the lighting system, details of lighting extensions to be left to Councilmen W. H. Murphy, Frederick Sawyer and City Engineer Thomson.

PETALUMA, CAL.—The Pacific Gas & Electric Company has obtained an order restraining the enforcement of a rate of $1.25 in Petaluma. It is claimed that the plant there is worth $90,000. The rate was at one time $3 per 1000 feet, but it was gradually reduced to $1.50, with a special rate of $1 to consumers of more than 15,000 feet. The Petaluma authorities have now established a maximum rate of $1.25, and it is against this figure that the company is fighting.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Company has obtained from Judge Van Fleet a temporary restraining order forbidding the enforcement of the 85 cent gas rate adopted for the fiscal year beginning July 1. In support of the plea for a higher rate, the gas company filed a petition asking that it be allowed to charge $1.25 per 1000

feet. It adds, however, that it has represented to the Supervisors that it will be satisfied with a $1 rate. This is the figure that the company will adopt if the restraining order is continued in force by Judge Van Fleet. Accompanying the petition are a number of affidavits. One made by E. C. Jones, the chief engineer, places a value of $11,.000,000 on the gas plant. John M. Britton, president of the company, estimates the value at $13,000,000 and adds $400,000 for other property and real estate. J. B. Butler, the auditor of the company, is not so modest in his computation and figures a valuation of $18,000,000. The company claims that the year just closed showed net revenue of only $68,473.25, which was converted into a deficit of $377,851.70, after the interests and sinking fund had been met. It asserts further that the expenses of manufacture and operation will be greater this year than ever before. The cost of distribution is estimated by President Britton to be in excess of 60 cents for each 1000 feet. The company claims that it should be allowed 10 per cent on its investment.

TRANSPORTATION.

IDAHO FALLS, IDAHO.—This place recently granted a street railway franchise and work will begin soon on construction.

WILMINGTON, CAL.—The Pacific Electric Railway Company has been granted an electric railway franchise on certain rights-of-way in this city.

MARSHFIELD, ORE.—John R. Smith has applied for franchise to operate steam or electric terminals in the city. Mr. Smith is backed by local capital.

BUTTE, MONT.—Manager Wharton of the street car company announces that his road will make extensive improvements and extensions to its system this year.

BELLINGHAM, WASH.—The Whatcom Railway & Light Company will extend its line a distance of 5980 feet. The improvement is known as the Happy Valley extension and will cost $12,000.

MARSHFIELD, ORE.—J. M. Blake has applied for a franchise for an electric railroad running on certain streets here and has also applied for a franchise to operate in North Bend. It is understood Mr. Blake is representing eastern capitalists.

NORTH YAKIMA, WASH.—N. C. Richards, representing eastern capital has taken over the capital stock of the Yakima Valley Transportation Company. One condition of the transfer is that the company build 13 miles of extension within a year, which will mean the expenditure of $500,000.

MARSHFIELD, ORE.—J. F. C. Clark and J. H. Somers have been granted a franchise for an electric railway between Marshfield and Coquille. They are said to be connected with the Coquille Mill and Fixture Company, which recently secured a franchise for an electric railway in Coquille.

LOS ANGELES, CAL.—The Ontario and San Antonio Heights Railroad Company is about to let a contract for the extension of its electric railway from Upland through Claremont to North Pomona, distance of 6 miles. The Pacific Light & Power Company officials are the principal stockholders.

SAN FRANCISCO, CAL.—Assistant General Manager W. R. Scott of the Southern Pacific Company says that it has practically been decided to use steel passenger coaches on the company's suburban lines when these are electrified. He also says that the new service should be begun on the Alameda lines about January 1, 1910.

MILES, WASH.—The big Bend Transit company which holds the power site at the narrows below Fort Spokane proposes to build an electric line along the Spokane river from Spokane to the Columbia river steamboat landing, above the mouth of the Spokane river and use the narrows for a power site.

LOS ANGELES, CAL.—The first step toward elevated tracks has been taken by the Pacific Electric Railway Company in a franchise asking for a bridge into the rear of the Pacific Electric depot at Sixth and Main streets. Plans and specifications for this bridge have been submitted to the Board of Public Works.

COLFAX, CAL.—W. S. Fletcher, a mine operator of Forest Hill, will apply to the Supervisors for a franchise to build an electric road between Colfax and Forest Hill. If granted the franchise Fletcher will agree to start the work inside of thirty days and the road completed within four months. The electric road will follow the present wagon road.

OAKLAND, CAL.—Plans for the extension of the suburban train service of the S. P. Company include a double track electric loop which will give the suburbs to the east of Oakland quick and direct connection with San Francisco. It is proposed to convert all of the suburban train systems into an electric system, and electric trains will be operated between the present Seventh street station, Berkeley, Alameda and as far east as San Leandro.

FRESNO, CAL.—Both corps of engineers working on the survey of the Fresno-Hanford interurban railroad are now near Laton. S. F. Granger, the promoter of this line, states that he expects work on actual construction will begin about July 15th, though a large force of men will not be put on until after the raisin curing season. He says that he believes there is plenty of time to wait until the fruit is cured before employing any large number of men in gangs, as the road has not to be finished until January 1, 1910.

SAN FRANCISCO, CAL.—The Supervisors have accepted by resolution the bid of Frank D. Stringham and his associates for the Stockton street railroad franchise, and followed it up by passing to print an ordinance granting the applicants the 25-year franchise asked for. Following this, George Skaller, the active promoter of the enterprise, announced that A. J. Lowenberg, president of the City and County Bank, is at the head of the syndicate backing the enterprise, which is made up of local bankers, and is to be president of the company when it incorporates.

SANTA ANA, CAL.—The last rail of the new electric line between Santa Ana and Huntington Beach was laid last week. The contract of the Pacific Electric with the Southern California Sugar Company was that the road would be completed and ready for operation by July 1st. It was prepared to operate excursion trains to Huntington Beach on July 5th, on which day that city and Santa Ana joined in a jubilee celebration at the beach town. The principal business of the road will be hauling sugar beets to the $1,000,000 sugar factory on South Main street, which will begin its first year's run about July 15th.

SACRAMENTO, CAL.—The Sacramento and Sierra Railway, which is to build a line from this city to Lake Tahoe via Orangeville Bluffs, has filed deeds for its right of way, which for the first time indicate the route the road is to take to approach the city. It will cross the American river from the Haggin grant at a point opposite Tenth street, and continue on what would be Tenth street if that street were continue on what would be Tenth street, if that street were produced to North B. It will turn west to North B and proceed down that street to Seventh, where the terminal will be located. The company has purchased 80 acres of land adjoining the terminal site. This land runs clear to the Sacramento river and will give the company excellent shipping facilities. Construction on the road at Orangevale Bluffs has already commenced.

OIL.

PETALUMA, CAL.—Superintendent McDonald of the Ramona Oil Company, has gone to San Francisco after some new machinery which will be installed at the company's plant on Sonoma mountain.

LA GRANGE, ORE.—D. M. Hunt has closed a contract with the Eastern Oil and Gas Company of St. Johns, Ore., to sink a 14-inch well to a depth of 2,000 to 3,000 feet, work to commence within 90 days.

LOS ANGELES, CAL.—The City Council passed an ordinance granting to the Union Oil Company the right to construct and operate a pipe line for purposes of carrying oil under certain public streets in the city.

SAN FRANCISCO, CAL.—The Associated Oil Company will supply crude oil for the Harriman river steamers and for the passenger locomotives on both the S. P. and O. R. & N. lines in Oregon. The contract entered into does not become operative until September 1st. It calls for the delivery of about 1500 barrels of fuel oil a day. Heretofore the Harriman rail lines have been supplied by the Standard Oil Company and the steamer lines by the Union Oil people.

SAN FRANCISCO, CAL.—Two of the largest and most modern oil tank steamers in the world have been built in England for the Union Oil Company of this city, and Captain Ferries, superintendent of the steamship department of the big corporation, has gone to bring the vessels out to San Francisco. Each of the vessels will have a capacity of 60,000 barrels of oil, or 8,000 barrels more than the huge carriers Santa Maria or Santa Rita. The two new steamers are expected to arrive here and go into commission within 90 days.

RICHMOND, CAL.—Agents of the Union Oil Company are looking for a site for a refinery at Point Malate, according to strongly credited reports in realty circles. The company is said to be closing on its options in Happy Valley, near Antioch, where the Union company has been making extensive borings for oil. The Union Oil Company agents are looking for a site where deep water can be readily be reached for easy handling of oil for water transportation. It is also reported that the company has been examining sites along the South San Francisco harbor front for the same purpose.

MEXICO CITY, MEX.—One of the biggest gushers in the history of the oil industry has just been obtained in a well near Tuxpan, State of Tampico. The daily output of the well is estimated at 200,000 barrels. It is located upon land owned by George I. Ham, an American banker of this city. It is a short distance from a big tract of land recently purchased by E. H. Harriman. Oil was struck at a depth of 2900 feet. The pressure is so strong that efforts to cap the well have not yet been successful. Earthen tanks are being constructed in which to store oil temporarily. It is reported that the Standard Oil Company has secured rights to the land.

COALINGA, CAL.—The eighth annual report of the California Oilfields, Ltd., covering the business of the corporation for the year ending December 31, 1908, has been submitted to the stockholders at a meeting held in London. It shows that of the total production of petroleum in California for he past year the Limited's output was over 7 per cent of the whole, or an aggregate of 3,553,678.77 barrels. A dividend of 20 per cent was declared making a total of 30 per cent for the year or about $600,000. The company had 73 producing wells on December 31st, and 16 wells drilling. It has never had a dry hole. The output of the company is almost entirely refined oil of high gravity, which finds a ready market owing to the scarcity of oil of that quality. In addition to other improvements and developments of the property in the past year the corporation acquired its own water plant, having purchased the property and equipment of the Valley Water Company.

WATERWORKS.

ACTON, CAL.—The Gold Spike Development Company made a contract with Smith-Booth-Usher Co. of Los Angeles to put in a large steam pump.

SANTA CRUZ, CAL.—The city engineer has been ordered to make a survey for an additional line of water pipe from Laveaga creek for the supply of the city.

SEATTLE, WASH.—The Council has passed a resolution providing for laying water mains and all tees, crosses, etc., necessary, in Tenth avenue N. W., within certain described limits.

MADERA, CAL.—Sealed bids will be received by the city clerk up to July 19, 1909 for the construction of a municipal water works plant in accordance with plans and specifications on file with clerk.

TACOMA, WASH.—The City Council has adopted a resolution directing the commissioner of public works to proceed at once with the Green river project which will provide a gravity system for the city.

IMPERIAL, CAL.—The City Council has passed an ordinance providing for the issuance and sale of interest bearing bonds amounting to $50,000 for the purpose of acquiring water works and a water system.

LOS ANGELES, CAL.—For the sum of $4088.70 the board of public works has awarded H. R. Boynton & Company a contract to furnish 63,000 feet of 2-inch merchant screw pipe with coupling for Owens river aqueduct work.

PORT TOWNSEND, WASH.—Sealed proposals are being received for furnishing material and doing the work of constructing an extension to the city water system, to Broadway and Wayson's additions, including about 4700 feet of 4-inch pipe.

REDONDO, CAL.—Sealed bids will be received by the Board of Trustees up to July 12th for furnishing and installing a centrifugal pump and motor, as per plans on file with the city clerk. Also for construction of a reinforced concrete tank.

PORT ANGELES, WASH.—W. W. Seymour, owner of the Port Angeles water system, has agreed to develop the Ennis and Lake Creek district as a source of supply for all parts of the city, including Lincoln Heights if he is given a new franchise and the matter of rates can be satisfactorily adjusted.

SEATTLE, WASH.—Sealed bids are being received at the office of C. D. Bagley, secretary of the board of public works for laying water mains, with all necessary appurtenances, in Earl avenue, N. W. Also, same time, place and conditions, bids for water mains in Thirty-first avenue south and bids for water mains in Eleventh avenue west, et al.

EUGENE, ORE.—The water committee has contracted with the Washington Pipe and Foundry Company for 5650 lineal feet of 100 inch wood pipe at 48½ cents per lineal foot and 5 cents per pound for cast iron tees, etc. The fire and water committee was ordered to present a scheme for a complete system for the extension of mains where most needed.

PORTLAND, ORE.—Walter O. Haines, representing Hogo & Swift, has made a proposition to the water board to sell the 17 defective hydrants which have been rejected by Chief Campbell, and which were a part of the order for 150 hydrants, for $7 less than the original price of $45.65, claiming that the difference would pay for new nozzle cutoffs for the hydrants. A motion has been passed providing for another test of the 17 hydrants, and if they comply with the requirements in every other respect, it is probable that the offer will be accepted.